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CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Western Gas Association..... 513
EDITORIALS—
Briefly Told..... 513
Obituary Note: Walter Burchard Houston—The Bids for Public Lighting, New York City—A Model Circular—Notes.
The Market for Gas Securities..... 514
Sixth Annual Meeting, Ohio Gas Light Association.—Official Report—Revised by the Secretary—Continued from page 484..... 515
Second Day, Morning Session: Another Year with Fuel Gas, by C. H. Evans—Discussion—Report of Committee on Location—Introducing the New Members. Second Day, Afternoon Session: Question-Box.
Public Street Lighting in New York, by E. G. Love, Ph.D..... 521
*Thwaite's Gas Fired Boiler..... 523
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 523
Cheaper Gas for Hoosick Falls, N. Y.—Annual Meeting Royal Electric Company, Montreal, Canada—New Holder for the Cincinnati Company—A Damage Suit—Extending the Pintsch System—Gas Company for Manchester, Va.—Cheaper Gas for Paterson, N. J.—An Addition to the Kansas City Plant—Public Lighting, Wilkes-Barre, Pa.—Big Figures—The Consolidation at Indianapolis, Ind.—The Cost of it at Bangor, Me—Corporation Counsel Darrow's Opinion—Death of Mr. Thos Earle—The New Plant for Chicago's Suburbs—Personal—Annual Meeting, Newburgh, N. Y.—The Berlin (Conn.) Iron and Bridge Company—Mr. G. W. Farnham Succeeds the Late Mr. Cushing—More about Wilkes-Barre's Public Lighting—Annual Meeting, Montreal, Canada—Hints from Marlboro, Mass—General Hickenlooper Captures the Electric Companies—Public Lighting, Stockton, Cal.—Cheaper Gas for Bristol, Pa.—And Many Other Items.

[OFFICIAL NOTICE.]

Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 9, 1890.

The Thirteenth Annual Meeting of the Western Gas Association will be held at St. Louis, Mo., on the 21st, 22d and 23d days of May. The Lindell Hotel will be used as our headquarters on this occasion.

The usual reduction in transportation rates has been secured and the necessary certificates for obtaining the same will be mailed to our members on or about the 10th of May.

On the 15th of February the Special Committee on the Assignment of Papers assembled at St. Louis for the purpose of choosing subjects and assigning authors for the same. It is a pleasure to state that the responses to the requests of this committee have, in almost every instance, been favorable. The Association can, therefore, rely upon the fact that the paper contributions to the Thirteenth Annual will be of a high order of merit. The list will be announced in these columns later on.

Although "The Western" contains on its lengthy membership list the names of a large number of executive officers of the gas companies that are embraced within its territory, the fact still exists—and it is a painful one—that there still remain a considerable proportion of our Western and Southern companies who have not yet sent delegates to our annual reunions. It is the intention of the Secretary to send a circular, calling attention to the great good accomplished by Gas Associations generally, to the President of each and every company that still remains unrepresented on our roll book, accompanied with a request that he shall send his Superintendent to our St. Louis meeting. These circulars will be issued at an early day, and will be mailed to every gas company President from the Alleghenies to the Rockies, and from the Great Lakes to the Gulf. If any of our members, or those who are contemplating becoming members, can lend a helping hand in this movement, they will confer a favor upon the Secretary. Application blanks and copies of our by-laws will be mailed to those who desire them.

A. W. LITTLETON, Sec'y.

BRIEFLY TOLD.

OBITUARY NOTE—WALTER BURCHARD HOUSTON.—The American Association is again called on to sorrow over another vacancy in its ranks in the decease of Mr. Walter Burchard Houston, who died at his home in Rahway, N. J., on the 3d inst., after a long and painful siege of illness. Deceased, who was in his 26th year, became identified with the Rahway Gas Company, and so well did he serve his apprenticeship therein that the proprietors, appreciating his worth, finally named him to fill the triple place of Secretary, Treasurer, and Superintendent. He accepted these duties at a time when the fortunes of the Company were at a very low ebb; but imbued with the idea that hard work and liberal management would restore the property to its original position, he applied both restoratives with unflagging zeal. As is not infrequently seen, when his efforts had been crowned with success, even to the point of putting the Company on a dividend paying basis, he was not permitted to enjoy the full fruit of his labors; for about the close of the spring of 1888 he was seized with hemorrhage of the lungs which eventuated in chronic phthisis. In the hope of alleviating, if not conquering the symptoms of his disease, he journeyed to Arizona, but failed of the hoped-for relief. He returned home last fall, to linger until the summons should come, and death's messenger was never received with greater resignation. In fact, from personal knowledge of the circumstances, we cannot refrain from expressing our admiration respecting the placid, uncomplaining manner with which deceased bore the ills that afflicted him. He was elected to membership in the American Association at the meeting held in New York city, in October, 1887, and was much interested in its welfare. His illness, beginning as it did shortly after his election to the Association, alone prevented him from becoming prominent in its affairs. He was a progressive engineer, a close student and a thoroughly cultured gentleman.

THE BIDS FOR PUBLIC LIGHTING, NEW YORK CITY.—Early last week the Gas Commission met for the purpose of opening tenders that had been received from the various gas and electric lighting companies in response to the city's invitation for bids for lighting the streets for 1 year, from May 1st. The figures submitted are as follows:

Name of Bidder.			Price per Light.
Consolidated Gas Company			$17.50
Mutual	"		17.50
Equitable	"		12 00
Central	"	(suburban)	28 00
Northern	"	"	27 00
Yonkers	"	"	27.00
United States Company (arcs)			39–42 cts.
Brush	"	"	39–42 "
Mount Morris	"	"	39–42 "
Harlem	"	"	39–50 "
East River	"	"	42½ "

The electric bids of course are on the basis of a charge per night, and the schedule for both classes is on the plan of 4,000 burning hours per annum. The Equitable's bid is for all lamps on its existing lines of pipe, and is a compulsory figure, inasmuch as its charter names that as the maximum rate that it may exact. Given in the order as they stand in the table, the electric companies bid on the following number of arcs: 314, 337, 175, 185 and 226. Much curiosity was awakened as to what advance the electric companies would make over the figures submitted by them in the preceding competition, and their propositions of a week ago may be averaged at a 20 per cent. increase. The alleged reason for the advance is the cost of subway rentals; but this cannot be accepted as the *only* one. The simple matter of profit and loss, in the instance of manufacture and distribution, beyond doubt shares with the subway rental in a fair attempt to account for the higher figures demanded. As the matter at present stands, it seems that the usual awards will be made to the gas companies, whereas the electric lighting apportionments cannot be made on the basis of the bid figures. In other words, owing to the increased rates demanded by the electric companies, the cost of their portion of the work will largely exceed the appropriation fund allotted by the city to carrying it on. The bids were referred to Secretary McCormick for tabulation and report.

A Model Circular.—Elsewhere we note that a concession had been made by the operators of the gas supply at Paterson, N. J., to their consumers, and since that item was written we have received a copy of the circular issued in making the concession known to the residents. As it seems to us to be a model circular, we herewith give its salient points in the belief that it may be of assistance to others when the time comes for them to take similar action.

"Office of United Gas Improvement Co.,
146 Ellison St., April 1, 1890.

"We have amended our discount schedule so as to lower the net prices on monthly bills of from 5,000 to 50,000 cubic feet. Gross price being $2 per 1,000 cubic feet, discounts are now allowed as follows, provided that bills are paid on or before the 10th of each month:

Monthly Consumption.	Discount.	Net Price.
5,000 cu. ft.....	12½ per cent.....	$1.75
5,000 to 10,000.....	17½ "	1.65
10,000 to 20,000.....	20 "	1.60
20,000 to 50,000.....	25 "	1.50

"We thank the public for past patronage, and assure them of our desire to continue to serve them well and faithfully. In continuance of past and present policy (not as a new departure), we place as the four cardinal points of our business compass—1, good service; 2, square dealing; 3, courteous attention; 4, prompt response to complaints; and hope to merit and obtain increased business. Using the best methods and materials known to modern gas making, we cannot but feel that we are furnishing a superior article. If there should be any cases of dissatisfaction, the causes will be found to be local, usually in the house-pipes or burners, and we would desire to be informed of any such cases and to have a chance to propose the proper remedies. We intend in the near future to have a house-to-house inspection of burner tips, etc., and trust to have the co-operation of each consumer. In this our object will be, not to increase the size of the gas bills, but rather to increase the illumination. In endeavoring to produce the best light and the most light for the least money, consumers' interests and our own are mutual. We have provided blanks to be given to managers of mills, factories, public halls or other large consumers, who may wish to have a record of each day's consumption of gas. We advise consumers to frequently read their meters, and are always glad to explain the method, or to give other necessary explanation or information. Gas stoves are now in use by hundreds of families in our city, both for cooking and heating. The convenience attending their use, and the saving of time, labor, and trouble, are now too well known to need more than mention. When properly used, the cost is no more (sometimes less) than that of coal. We handle stoves at cost, and would prefer to sell them, making, if desired, very easy terms of payment. We also have stoves to rent at low monthly rates. We have other convenient arrangements, such as self-lighting burners; nursery burners, for quickly heating over an ordinary gas flame small quantities of water or other liquids; curling iron heaters; iron heaters for family use, for tailors, laundries, etc.; waffle and cake bakers, etc., etc.—United Gas Improvement Company."

Notes.—Professor Chas. L. Robbe, of Trinity College, has been appointed Official Gas Examiner for Hartford, Conn. We congratulate the authorities and the Gas Company on his selection; for his past record is the best guarantee of his fitness, capacity and impartiality.——The proprietors of the Hartford (Conn.) City Gas Company have determined to install an auxiliary water gas plant. In all probability the contract for same will be awarded to the United Gas Improvement Company, with instructions to erect a double set of the improved type of Lowe apparatus, each set to have a per diem capacity of 250,000 cubic feet.——Mr. Chris. Felt, a brother of Mr. Henry Felt, Supt. of Distribution to the Cincinnati Gas Light and Coke Company, has been appointed Superintendent of the Addyston Pipe and Steel Company's works.——The streets of Tyrone, Pa., have for the last three years been lighted by means of 25-candle power incandescent electric lamps, the contractors maintaining 100 of the same on the basis of a charge of $1.33 per lamp per month, moonlight schedule. The number of lamps in use was 100. As the contract expires on May 1st, the authorities asked for tenders for another 3-year agreement with the following result—the bids were opened on April 7th. Tyrone Electric Light Company, 25-candle power lamps (100 in number), moonlight table, $1.50 per month each; all night and every night, $2; Jones & Underhill (Columbus, Ohio) for naphtha lamps, $19 per lamp per annum; the Tyrone Gas and Water Company did not tender. In view of the increased rate demanded for electric light, Council deferred action in the matter of an award.——During the year Director Wagner reports that 5,241 new meters, and 10,076 new services, were placed through the Philadelphia Gas Bureau last year in that city; that the number of additional burners placed footed up at 113,474; and that the total number of gas consumers is 128,867.——Mr. J. W. R. Cline, whose promotion has been fairly won through a 15-year term of apprenticeship, so to speak, in the service of the Company, has been appointed Superintendent of the Springfield (O.) Gas Light and Coke Company, vice Nathan Kinsman, resigned. Mr. Kinsman, who has served the Company most acceptably for something like 35 years, retires on account of ill-health and advancing years. The fraternity will unite with us in the hope that rest and travel will speedily restore Mr. Kinsman to his old-time physical condition. Mr. Cline has acted as Assistant Superintendent of the works for some years.——Mr. George W. Harper has resigned from the Superintendency of the Fall River (Mass.) gas works, in order to accept a more responsible position in the same line of business at Kansas City, Mo.——Mr. R. B. Taber, as Clerk of the New Bedford (Mass.) Gas Light Company, gives notice that a special meeting of the stockholders is called for Wednesday next, to decide (1) whether the Company shall purchase the rights, privileges, etc., of the New Bedford Edison Electric Illuminating Company; (2) to authorize an increase of the capital stock; (3) to amend the by-laws so as to provide for increasing the Directorate to 11 members.——Messrs. John W. Wright, Thos. C. Young, John S. Latta, Jas. L. Armstrong, John E. Wright and Wm. J. Latta, have applied for a charter for a Company to be known as the Parkersburg Gas Company, "the character and object of which is to manufacture and supply gas for light only to the public at the Borough of Parkersburg, Chester county, Pa."——The Brooklyn (N. Y.) Gas Company will construct an additional holder.——The Charlton suit against the Gas Trust has been withdrawn, and a sum of money equal to 1 per cent. on the common stock has been "disbursed" by the Trust's Treasurer.——Mr. W. C. Whyte, of New York, will build the tank for the new holder to be constructed by the Peoria (Ills.) Gas Light Company.

The Market for Gas Securities.

The city market for gas shares shows no change from the time of last writing, although investment inquiry was rather more on the brisk order than has ruled for some time back. To-day's (Friday) opening sales were effected at 96½ for Consolidated, and Equitable was sought for in a quiet way. Mutual, too, fully holds its own. In fact, it is undeniable that city gas shares are now attracting more attention from "safe" investors than has been the case for some time back. We hold to our prediction of a month ago that Consolidated will cross the par line before the summer is over. In Brooklyn shares no change of moment has occurred, and the situation there seems to be all in favor of the holders. The Edison Branch Company in Brooklyn may be written down as a very weak competitor of the gas companies—all large users of the incandescent light supplied from the Pearl street station are dissatisfied with the lighting service and its cost. The usual quarterly dividend of the Newark (N. J.) Company (2½ per cent.) has been declared, as also has the Citizens' (same city) allotment of 2 per cent. Chicago Gas Trust stock is in demand to-day at 45½ to 45¾, and the holders thereof have received a sum equivalent to 1 per cent for the last quarter, and are now engaged in an attempt at solving the riddle propounded in connection therewith by the Trust's Treasurer, who says that the aforesaid 1 per cent. is not in the nature of a dividend, but is a "disbursement." Permitting it to go at that, we may remark that the meeting on the 24th inst. will undoubtedly witness a reorganization of the Trust that will bother even a Chicago lawyer to find a flaw in.

[Official Report.—Revised by the Secretary—Continued from page 484.]

SIXTH ANNUAL MEETING, OHIO GAS LIGHT ASSOCIATION.

Held at the Boody House, Toledo, Ohio, March 19 and 20, 1890.

Second Day—March 20—Morning Session.

Mr. C. H. Evans, of Jackson, Mich., now read his paper on—

ANOTHER YEAR WITH FUEL GAS.

Mr. President and Gentlemen:—One year ago it was my privilege to present to this Association a paper on "Fuel Gas," and to-day I am called upon by our worthy Secretary to renew this subject.

Many of you, no doubt, have heard at the various Association meetings, or read in our gas journals, a great many papers and articles on this subject during the past year. Some of them have been of an encouraging nature, while others, and I might say the most of them, have been decidedly the other extreme; but if you stop to consider a moment you will remember that the words, "assume," "if," and "theoretically," occur at frequent intervals. No doubt the writers have given the subject much careful thought and study; but who among you can tell by theorizing what will occur in practice?

I could monopolize your time for hours on the theoretical possibilities of fuel gas, but that does not satisfy. Facts are what we want—facts demonstrated by actual results—and until such facts can be presented beyond all possibility of doubt, few gas managers would care to venture, in a business way, into the unknown—few would care to run the risk of success or failure, judging of the conditions from a theoretical standpoint.

There is no longer any necessity to theorize; there is no longer any reason to doubt; for 70 miles from this very city there is a fuel gas plant in operation, doing a business that ought to convince the most skeptical. A plant that is not of the mushroom order, but is built to stay, and is second to none of its size in the country in mechanical appliances for reducing labor to the minimum.

It may not be uninteresting at this point to describe what I am pleased to term our model purifying house. It is a brick building, approximately 40 ft. wide, 115 ft. long, and 30 ft. high to under side of roof trusses. Our boxes, 4 in number, are 20 ft. by 20 ft. by 4 ft. deep, and hold 1,000 bushels of purifying material, each. They are supported on iron girders 12 ft. above the cemented basement, which leaves this latter space entirely free from columns and gives ample room for revivification of purifying material. As the lower floor is level with the street, it is easy of access, and the numerous windows afford ample light with plenty of opportunity for rapid circulation of air. The covers are lifted and moved by hydraulic machinery, and the purifying material is handled almost entirely by a system of conveyors, which I will describe. There is a line of conveyors running over the purifiers, which are provided with two discharge openings, operated by slide valves over each box, and another line is suspended under the bottom of the boxes that has two openings, directly under the two discharge pipes in the bottom of each box—this line also has slides in the bottom at frequent intervals. A third line is placed in the center of the lower, cemented floor, the top being flush with its surface, and runs the entire length of the building, having slides or openings at desirable points. An elevator (similar to those used to handle grain), a steam drum and shovel, complete the list of machinery necessary for one man to do the work of six or seven. The *modus operandi* is simple. One man steps into the field, whenever it is necessary to clear a box, at, say, 7 o'clock in the morning, and starts the machinery. The cover is lifted by hydraulic device, the man steps into the box and lifts out the trays that are over the discharge openings. As these trays have rods attached to them that protrude above the material, the lifting out is easily accomplished. The material is shoveled through discharge pipes to conveyor below, which carries and deposits it at any point desired by simply opening the slides; the emptying is done in short order, and the man, after opening the two discharge valves over the boxes, descends below, hooks on his steam shovel to rope attached to drum, and drags the material required for filling to the center conveyor. It is carried along by the latter to an elevator at the end of the building, which receives it, elevating it to the floor above, depositing it in the conveyors over the boxes. This line conveys it to and deposits it in the proper box, and there is nothing left to do but level it off, and this is easily accomplished by 6 o'clock, with the labor of one man. The freshly deposited material below is leveled by a steam shovel and turned at proper intervals by a steam plow.

Our system of handling coal is somewhat similar to the above. The coal, which comes in on a side track, is shoveled direct into a hopper, connected to an underground line of conveyors, which carries the coal to our shed, where it is elevated and deposited at any desirable point. The same line of conveyors brings the coal to our generator house, where it is elevated and delivered into a scale hopper, which not only automatically weighs the coal, but rings a bell in the coal shed whenever the desired amount is in the hopper. The coal truck is wheeled under the hopper and filled by opening a slide.

It is somewhat alarming to contemplate the erection of a fuel gas plant, looking at it from the standpoint taken by Mr. John Young, in his recent paper read before the American Association; but as his estimates are taken and his conclusions drawn from his experience in the sale and delivery of natural gas, I am not surprised at the figures. In fact, I can easily credit the statements since I made a personal investigation of the appliances in use at Allegheny. No attempts had been made, that I could ascertain, to use the gas economically. The coal stoves and furnaces filled with broken brick, and the gas attached thereto, were in universal use. Under such conditions is it to be wondered at that such vast volumes of gas are required and such fluctuations in demand should exist? As an illustration of the differences that proper appliances make in the consumption of gas, I will give you the figures of gas consumed by two houses—one fitted up with a gas furnace, and the other with the gas attached to an ordinary coal furnace filled with brick. The former is a 14-room house, and was warmed throughout during the winter months with an average consumption of 39,000 cu. ft. per month. The latter was a 10 room house, and required a consumption of 125,000 cu. ft. per month.

In the manufacture and sale of illuminating gas the whole distribution occurs in practically 4 hours of each day, and necessitates a storage capacity at least equal to the output, or a manufacturing capacity equal to three times the output, if the storage be reduced one-half. The mains also have to be of sufficient size to supply the entire daily output in practically 4 hours.

Is it not plain to be seen that certain mains supplying a given quantity of illuminating gas would, if used to supply fuel gas, where they are in use 18 hours each day, distribute 4½ times as much as the latter? Is it not consistent to claim a decrease in holder capacity in the same ratio? There is equally as wide a difference in the winter and summer output of illuminating gas as could possibly exist in the supply of fuel gas. Mr. Young must certainly have had some standard of comparison in mind when he said that the storage capacity of a fuel gas plant would have to be simply enormous; but he certainly could not have used the supply of illuminating gas as a comparison to draw his conclusions from. My daily record shows no such erratic demand as Mr. Young assumes must exist. He is generous enough to credit the possibility of getting 30,000 cu. ft. of fuel gas from a ton of bituminous coal, while the facts are, we are getting 40,000 cu. ft., and have every reason to expect 50,000 from improvements now in process of construction.

What constitutes the success of any business, if it is not the selling of its goods? The fact that people buy shows that there are certain merits in our gas, else why should they continue to use it? Why should our business continue to grow and our receipts to increase if the supply of fuel gas is not a success? Is it necessary the gas should be in every house in Jackson before it is entitled to the claim of success. Such seems to be the impression of some gas engineers.

I had occasion a short time ago to read a number of letters from different gas managers, which were in answer to inquiries of a certain party who proposed to introduce fuel gas into the city where he resided. I was painfully surprised to learn the opinions of some of the success of our Jackson plant. Especially so in this case, because I am positive that the engineers in question never were in Jackson to investigate the system in use, but were only too willing to cry down something they knew nothing about.

There seems to be a popular fallacy existing among a great many gas engineers that illuminating gas has 2½ times the practical calorific value of fuel water gas. This is probably due to the assumption that the heat of combustion of a composition of gases is the same as that of its elements. The fact is usually the reverse. Thus, marsh gas, CH_4, which forms more than one third of the bulk of coal gas, is composed of three parts (by weight) of carbon and one part by weight of hydrogen. In one pound of marsh gas the heat of combustion of its elements, when burned separately, is, for carbon, 10,914 units, and for hydrogen 15,381, making a total of 26,295 units as the combined heat which one pound of marsh gas ought to yield. But by actual experiments the heat evolved is only 23,616 units; hence marsh gas in burning evolves 2,672 units per pound less than its elements, or a loss of about 12 per cent.

Another serious drawback to the practical utilization of the heat in the combustion of illuminating gas, is due to the admixture of such vast volumes of nitrogen which of necessity must be taken in to obtain the proper amount of oxygen. This nitrogen not only absorbs the heat and detracts largely from the flame temperature of the gas; but by its insidious presence it casts off into the atmosphere unconsumed gases the moment a cold vessel is placed in contact with the flame. In fact, I can safely assert that the air dilution necessary for the complete combustion of illuminating gas, detracts from its theoretical value fully 50 per cent. This would not appear to be the case if the specific heat of the nitrogen which enters into the composition was substracted from the theoretical heat evolved. But this is simply another illustration of the difference between theory and practice. As fuel water gas requires but 2.47 cu. ft. of air for the perfect combustion of a cu. ft., it is slightly affected, comparatively speaking, by the air dilution.

Many tests have demonstrated the fact that illuminating gas, as used for cooking and heating, is worth but 30 per cent. more than fuel water gas, instead of 2½ times as much.

Let us review the oft-trodden ground and see if there is not some reasonable possibility of making the general sale of fuel gas a success. There are certainly elements of advantage in its use that ought to make it preferable even at a higher cost than a solid carbonaceous fuel.

First.—The cost, labor and inconvenience of handling a heavy material is avoided, the fuel being capable of easy distribution.

Second.—It is in a form also free from those material impurities which involve a large residual waste, besides impairing combustion.

Third.—It is also free (if it be a purely combustible gas) from those ingredients which, in the present methods of heating, involve even larger loss than the cause last mentioned.

Fourth.—It is in precisely the condition to unite perfectly and instantaneously with the oxygen of the air, thus securing a thorough combustion. Hence it gives an immediate and uniform result, and its flame temperature is constant.

Fifth.—The intense and steady heat of the flame just mentioned saves both time and money, by presenting an even fire surface ready at the moment of ignition.

Sixth.—It is a fire capable of concentration upon the precise point where the result is desired, and one that is thoroughly under control—the turning of a valve starting, graduating or stopping the combustion at will.

Seventh.—The general cleanliness of the system, no dirt or residuals being left.

Eighth.—The decided advantage from a sanitary standpoint of simply burning combustible gases in our dwellings, instead of attempting to make them as well, by means of the imperfect gas machines called stoves. In the one case, the only risk arises from the possibility of a leak, readily detected by the sense, and having simply mechanical remedies; in the other it is a much more serious risk, because the defect is a chemical one, consequent upon imperfect combustion, and the infusion of poison into the atmosphere is likely to be frequent and insidious, to say nothing of the deoxidization of the air by contact with red-hot iron surfaces.

These facts appear to be overwhelming arguments in favor of a gaseous fuel as against a gross form, and it is a matter of some considerable surprise to me that every family on our lines of main is not a consumer. But there is one class of people that always wait to see what their neighbor is going to do, and another class that is afraid of everything new. But, nevertheless, there are between eight and nine hundred families consuming our gas, and $\frac{9}{10}$ of all the business places in the city are lighted by our method of illumination. To this last feature I want to draw your special attention, for I do not believe a fuel gas business can be perfect and complete without an incandescent burner. The one we have in use at Jackson (the Fahnehjelm) has during the past year made such rapid strides towards perfection, that, to one who remembers it when first brought before the public, the change seems marvelous. The comb has now double the life it had a year ago, and emits a beautiful, straw-colored light, that is very attractive to the public, as the fate of the now defunct Jackson Gas Light Company will testify.

A series of photometrical observations, which I have made from time to time with the Fahnehjelm burner since its improvement, shows an average of 5-candle power per cubic foot of gas burned for the first 150 hours burning, and a gradual diminution until, at the expiration of 250 hours, it has decreased to a shade less than 3 candles per cubic foot of gas consumed.

I removed 4 burners from a chandelier in my house that had been in use for 38 days, in the months of December and January, and had been burned at least 190 hours. A photometrical observation of the burners showed an illumination equal to 3.9 candles per cubic foot of gas burned.

One burner which costs the consumer 4 cents practically represents the oil that is used to carburet a thousand feet of water gas, as well as the additional amount of fuel expended in bringing to proper temperature the surface used to gasify the oil. In many places, the cost of carburation of oil reaches from 25 cents to 30 cents per 1,000, and in no instance has the cost reached so low a figure as is represented by our Fahnehjelm burner.

That fuel gas has established itself in the field to stay, I do not believe there is any longer need to doubt.

Discussion.

The President—You have listened to the paper of Mr. Evans, which I doubt not has been a source of satisfaction and instruction to those present, and I trust that the discussion shall bring out as much of value as the reading of the paper has.

Mr. Cantine—I believe all the courts of this country have decided that however credible a witness may be it will do him no harm to be corroborated. I was in Mr. Evans' works at Jackson, Michigan, at a time when he was not present. However, his Superintendent treated me very courteously. I believe his purification plant and apparatus are really better than he said. His description hardly makes the plant out as good as it really is. The coal benches were of about the usual type—having 3 benches and 12 cupolas on the same floor. The hot coke was drawn out from the retorts and was blasted up and made fuel gas by the use of steam. One question that puzzled me a little (perhaps Mr. Evans will kindly enlighten us) was that they made an excellent quality of coal gas, but the Superintendent didn't tell me what they did with it. I asked the question, and, I think, I got no answer.

Mr. Evans—I will say in answer that we have about 7 miles of mains that do not parallel our water gas mains, and we have on the former between 500 and 600 consumers of coal gas. The amount of gas necessary for these consumers is separated in the process of manufacture and delivered to them through the old Company's mains. The balance of the gas is sent back and into water gas. We have three generators in use.

Mr. Cantine—I understood the Superintendent to say that your price was 30 and 40 cents, according to the quantity used. Am I right?

Mr. Evans—Yes, sir.

Mr. Printz—I would like to ask Mr. Evans if they have shut down the coal gas works entirely?

Mr. Evans—Yes, sir; we have not only shut it down but taken it apart and sold it.

Mr. Printz—Then, again, I wanted to ask you what was the price of solid fuel—that is, of soft and hard coal—in your city?

Mr. Evans—The coal mined in Jackson carries considerable sulphur, hence very little of it is used for fuel purposes, except in the rooms. The bituminous coal used is brought from the Ohio region, and costs at retail to the consumer about $4.50 to $5 per ton. Anthracite coal in the summer season can be bought for $6 or $6.50 at the outside per ton.

Mr. Printz—I would like to ask whether you buy pea, nut or lump coal, and whether it is Youghiogheny or native coal that you are using in your fuel plant. And another question as to the comparative cost between heating a house with your gas and with heating that same house with solid fuel?

Mr. Evans—We are now using Youghiogheny nut. The cost of heating a house with gas, as compared with solid fuel, varies considerably—you would be surprised how much. In some instances it costs from 25 to 30 per cent. more, while in other instances it is just the reverse. It depends a great deal on the consumer. If they use the gas wastefully—that is, leave it on at times when they don't require it—it is likely to be more expensive than the solid fuel; but with the steady heat coming from the gas stove or gas furnace your house becomes thoroughly warmed, and not only thoroughly warmed but warmed uniformly through the whole of the 24 hours. There is no variation. In the use of hard coal the temperature goes down—it is only when it gets down to the point where you can notice it that someone is sent down to look after the furnace—then cold fuel is put on the fire and it is at least half an hour before you feel the effect. There is an interval of time when you have not been heating your room up to the proper degree of temperature. All these things have to be considered, of course.

Mr. Hyde—What appliances for heating houses do you use in Jackson—what kind of furnaces?

Mr. Evans—One made especially for it, or a furnace made especially for the gas, so that the products of combustion will go out of the chimney at the very lowest possible degree of temperature.

Mr. Hyde—What does it probably cost to heat the lower part of a house of 4 good-sized rooms?

Mr. Evans—Representing how many cubic feet of space?

Mr. Hyde—The rooms probably 16 feet square—or four rooms 14 by 16 each.

Mr. Evans—Say, 2,000 cubic ft. space—8,000 feet altogether. About $32.

Mr. Hyde—For how long a time?

Mr. Evans—In the winter season—the heating season—I have made a great many experiments in that direction, and find that the safest figure I can reach is about $4 per 1,000 cubic feet of space, heated under the general conditions.

Mr. Printz—Mr. Evans, does the Fahnehjelm comb hold its own with incandescent electric light as well as illuminating gas of 18 or 20-candle power?

Mr. Evans—I think I can safely say it does. I think the secret of illumination by incandescent electric light is the fact of the distribution of that light. It is hung around in different parts of the room and distributed thoroughly. The light from a chandelier emanates from one point, and the walls of a room, and every place where you look for the effect don't seem to have the light cast equally; at the chandelier there is an excess of light. I don't think any business places in the country are lighted as well as those lighted with the Fahnehjelm burner. I think it is due to the fact that the light is cheap that they want more of it. When the bills come in they are so reasonable that they feel they can afford more illumination.

Mr. Dittmar—Will Mr. Evans have objection to giving us the actual cost, delivered through the meter, of the gas at Jackson? Another question, while I am up, is whether he has had experience enough to give us the actual cost of a cook stove for one month—say, for a four-hole top—for a family of half-a-dozen? We people that are in the natural gas region would like to compare prices with those that are using the artificial fuel gas.

Mr. Evans—In answer to the first question, the cost of delivering to the meter is a very uncertain figure in the delivery of any gas—that the cost of the gas in the holder is quite uniform, but the cost of delivery is very irregular, which of course is due largely to the office expenses and the salaries of the officers of the company. In some cases they are paid three times as much as they are in other cases, and the office expenses consequently exceed in the same proportion. The cost of gas for a month, for a family of six, cooking on a four-hole stove, I should estimate to be about $1.30, if used economically. In fact, the cook stoves that are in use show a consumption that varies from 16 cents a month to $5. In the latter instance, it is due to the fact that the party who uses the stove cooks for 18 men—boarders, laborers—and the stove does all of the cooking—meats, bread, in fact everything.

Mr. Dittmar—Is that the ordinary cook stove—the old cook stove converted into a gas stove?

Mr. Evans—A cook stove made especially to burn gas.

Mr. Dittmar—Do you find any difference in the cost of the fuel where the old coal stove is converted into a gas stove and where they use a stove especially made for gas?

Mr. Evans—Yes, a decided difference; I should estimate it would cost three times as much at least.

Mr. Printz—I can readily see that the statement Mr. Evans makes is true in regard to the diffusion of the electric light. Latterly I have noticed that electric light people, in placing the incandescent burners, place them around the top of the room, near the ceiling, about 8 feet apart, so that their lights are divided and reach where you would like to see. Mr. Evans says that the gas is concentrated at the chandelier. A question I would like to ask Mr. Evans is as to the price charged for the illuminating gas and that charged for his fuel gas; and whether there is any difference made between the consumers who have only the illuminating gas and those that have both—whether you discriminate?

Mr. Evans—No; we make no discrimination at all in the prices of the illuminating coal gas. It is sold at $1.35, net, and we aim to make a very good quality. We don't want it said that we reduce the quality of illuminating gas in order that the Fahnehjelm burner may be introduced in its place. We supply a 19-candle gas, which is about as high as you want to send out coal gas. We often carburet it by the use of a little oil, in order to bring it up to the right standard. Those who consume 5,000 feet of water gas a month get their gas at 40 cents a thousand, with a rebate of 10 cents a thousand if paid on or before the 10th. If less than 5,000, it is billed to them at 50 cents per thousand, with a rebate of 10 cents. I might state, as a comparison between the lights, that the incandescent electric light company had about 1,000 burners there a year ago. They now have 800 in, and I think in a short time they will have about 600, as there are about that many changing now. The incandescent electric light is sold there now for about what they can get. In some places I know they are paying but 20 cents a month per lamp.

Mr. Printz—Is that the Edison incandescent?

Mr. Evans—Yes, sir.

Mr. Printz—Yesterday afternoon, during the course of a conversation with Mr. Evans, he made some statements and gave me some figures, and for the benefit of the discussion I would like him to make the same statement—that is, in regard to the yield of coal per pound that you get in these retorts, and the yield you get from the coke in your generator.

Mr. Evans—We are using in our benches Lima crude oil, and are aiming to keep a very uniform heat. We are able to keep any temperature we desire. We also use it under our boilers. We are now running our retorts on about 3½-hour charges, on 1,800 pounds. We obtain from every pound of coke that enters the generator at least 20 feet of gas; a great many days it runs up to even 30, but when I say 20 I take the average—not for a week nor for a month, but for two months or three months, because those who manufacture water gas know how that varies each day. From the bituminous coal in the retorts we can and do realize over 5 feet. The balance of the illuminating gas that we do not require to supply those that use illuminating gas is drawn back by the exhauster and forced through the generator tubes and sent out in the form of hydrogen into the water gas. The marsh gas is thus converted into hydrogen, and for the actual number of feet of illuminating gas that enters our generator we receive 30 per cent. more in the form of fuel gas.

The President—One feature alluded to in Mr. Evans' paper I may not have got exactly right. I only listened to it as it was read, without any further knowledge of it. The vital question with most of us, I think, in this connection is whether we have or are tending toward the realization of a perfect fuel gas system, and whether the conditions are met in the experience at Jackson thus far with reasonable certainty. The point is made that Mr. Young's experience with natural gas, and his comparison with illuminating gas, hardly represents the conditions. It has occurred to me that possibly Mr. Evans' experience has not been so very extended until the past winter.

Mr. Evans—I have had experience in the distribution of fuel and water gas for the last seven years. In fact, water gas was introduced into Lynn, as I said before this Association a year ago; but under the conditions I detailed then it could not be a success. However, from that I gained a great deal of valuable experience, which I would hardly want to go through again, I assure you. So that in starting into the fuel gas business in Jackson I had the benefit of that experience. As in everything else new, hardly a day passes that one does not learn something; and although I think we are achieving success there without doubt, we are not sitting down satisfied with what we have already obtained. In fact, we are erecting a generator there now—although we have no special use for it so far as adding to our present capacity is concerned—in which we propose to introduce bituminous coal direct. It will not only coke its coal, but will save the labor of drawing the coke from the retorts. I would be glad to give you a more clear explanation if I was at liberty to do so.

The President—The point in my own mind that I have not quite reached was with reference to the storage capacity that Mr. Young had concluded would be necessary. The winter that he had just passed through had been an exceptional one in the relation of the fuel supply to the necessities to be met, either by an amount of plant sufficiently large or capacious, with the necessary help to run it, or, on the other hand, a sufficiency of storage to supply the conditions. I think perhaps the conditions of supplying illuminating gas would not furnish exactly a criterion, but a wider range of conditions would have to be met. These features are only thoughts that occur to me, and I had hoped, perhaps, we might bring out still further light from Mr. Evans' experience. As we take the use of illuminating gas, its fluctuations depend very largely upon the variation of daylight. You know that means quite considerable. Mr. Hyde has already alluded to it, but how much greater it is when you consider the vastly larger output which will be necessary, in any event, for fuel purposes, and the fact that our temperature sometimes changes from about freezing to many degrees below zero within, I was going to say, 18 hours' time—say within 24. It seems to me here is a factor that the past winter furnished us no criterion to judge by at all.

Mr. Rood—Mr. Evans, did you ever experiment so as to get the exact comparison between your fuel gas and hard coal for heating, under similar circumstances?

Mr. Evans—Yes, sir.

Mr. Rood—For instance, take the same room and heat it to a certain temperature by your fuel gas and with coal?

Mr. Evans—I have done so.

Mr. Rood—What was the result?

Mr. Evans—It showed that 20,000 feet of the gas was equal to a ton of anthracite coal.

Mr. Rood—Was that by actual experiment?

Mr. Evans—Yes, sir; by metering the gas.

Mr. Rood—What is the price for your gas in Jackson?

Mr. Evans—The lowest rate is 30 cents a thousand.

Mr. Rood—Then your conclusion was that the cost under the same circumstances is about equal?

Mr. Evans—I think in the majority of cases it would be a trifle more, owing to the fact of their not understanding just how to manipulate their gas stoves and furnaces to get the best results. That, of course, is our greatest trial. In the use for cooking purposes gas does not cost one-quarter what coal does.

Mr. Rood—Have you had improved stoves and burners for your fuel gas during the last year and a half?

Mr. Evans—Yes, sir; I think it was about a year ago that we began to manufacture our own appliances, from our own patents, made from the result of experience.

The Secretary—I would like to ask Mr. Evans if he has tried any of the heating stoves made by the Century Gas Stove and Furnace Company.

Mr. Evans—No, sir; I have not. I have received their catalogues, and intend to make a trial of their goods; but I have not got to that point yet.

Mr. Rood—Is your present gas stove improved so that any fumes that may arise from the burning gas are carried off?

Mr. Evans—The heating stove?

Mr. Rood—Yes, sir.

Mr. Evans—In some instances the air is vitiated and saturated with carbonic acid if the room is too close; but no fumes come off from the burning gas.

Mr. Rood—Are your stoves arranged so that they are connected with the flues of the house—so that any impurities that may arise are carried off; or do they come into the room?

Mr. Evans—About half of them are connected with the chimney. That is left to the consumer. The conditions are explained thoroughly and they can do as they see fit.

Mr. Rood—Which would you recommend?

Mr. Evans—I would recommend connecting with the chimney in every instance. It does not take any more gas in any instance to heat a room when the stove is connected with the chimney than when it is not. The hydrogen in the gas is formed into moisture, saturates the air, increases its specific gravity, and requires more heat to heat that space than it would if the moisture and carbonic acid were carried off. By arranging your stove pipe with the proper sized damper you can pass the products of combustion out of that stove pipe at the temperature of the room or very nearly so.

Mr. Rood—It also acts as a ventilator in the room for ventilating the room to a small degree?

Mr. Evans—Yes, sir.

A vote of thanks was tendered Mr. Evans.

Report of Committee on Location.

Mr. Printz—The committee in their conference this morning met with a very serious obstacle. There were no applications from the members to have the next meeting at their places, but several said they would like very much to have the Association meet in their cities only that the banquet feature would preclude them from asking it to do so. They made the statement that while they themselves would like very much to invite the Association to meet there and to give them a banquet, they individually did not feel able to do it, and while they were officers of their companies, they did not feel like taking the responsibility of asking the Association to meat there with the expectation of being furnished a banquet. They were afraid, in some cases, that their Directors, or the members of their company, would not sanction an invitation of that kind, and would not back them. Several, and I might say more than several, have expressed themselves to me in this matter that they were opposed to the banquet feature, and that their understanding when the Ohio Association was formed was that there was not to be anything of that kind. One or two said to me that the cost necessary to give a banquet would be as much as one per cent. on all their capital stock, and they did not feel like an expenditure of that kind. In two invitations—I could hardly say they were invitations, either—it was intimated that the offerers were perfectly satisfied, and in fact would like to have the Association meet at their places, with the understanding that they were not to expect a banquet from their companies. If, after the place of meeting was selected, the companies which they represented saw fit to give a banquet, well and good; but they would not promise that there would be anything of that kind. Columbus has been named, so has Cleveland, and Zanesville is a third. The gentlemen representing Cleveland say they would like to have the Association meet there, but they would prefer to have a conference with their officials, and would rather have the meeting there the following year. The gentleman representing Columbus would like very much to have you go there. He has an eye open to the business interests of his city. Some others have spoken to me about Zanesville as being near the central portion of the State, a point which is very readily reached by railroads, and which all our members could get to in a very short time. They did not think we ought to go twice in succession to the northern portion of the State. They did not feel that we ought to go as far south as Cincinnati—that the Western Association had been there a very short while ago. For these reasons we have selected, and the Committee would report in favor of, either Zanesville or Columbus, with the understanding that a banquet is not promised. I can say, and Mr. Allen, who is Secretary of our Company, agrees with me, that if the Association chooses Zanesville we will agree to treat you well and see that you are entertained very well, but we will not promise a banquet. Mr. Butterworth, of Columbus, says the same thing. That is the report of the committee, Mr. President, and if the members please I would like to have them express themselves with regard to this banquet feature.

Mr. Cantine—Mr. President, what is the matter with Alliance? We have made about enough money out of our water gas plant in the last year to pay for a banquet. (Laughter.)

Mr. Printz—I am only sorry, Mr. President, that Mr. Cantine did not present his application.

Mr. Hyde—Mr. President, naturally, under the circumstances, I would not say anything about this business, because I am a new member. I am a member of the American and of the Western Associations, and have brought to myself some little notoriety in reference to this banquet business. I would not say anything now except that it has been brought out, by the report of the committee, that considerable opposition is manifested in regard to having a banquet. I want to say with reference to this (as I can now), that I have always been opposed to having any banquet, and, if we have a banquet, to having any liquors of any kind. There are some cities that can afford to provide a banquet. It is all right that they should, so far as that is concerned. They are perfectly able to, and perfectly willing; and those who go there are perfectly willing that they should furnish it and pay for it. But there are some who cannot do that. In some of the smaller towns, as the chairman of the committee has said, it would take 1 per cent. of their capital to pay for the banquet. Well, now, we ought to have a little regard for our brothers as well as ourselves. We should not engage in any methods that would compel others to do what they can't do, or what they are not able to do. The easy way to get along with that is to have none. Now we could have this evening our tea, or supper, or whatever you choose to call it, at the usual time, and adjourn to this room and have our little talk. That costs nothing. We are going to pay for our keeping here to-night anyhow, and if we have a banquet we are going to pay for that, too; and, besides that, we are going to pay for staying a day longer than we want to. There are three pays. Now if we could do it in this way—have our supper in the usual way, and have with it this entertainment, this "flow of soul," without the flow of liquor and wine, and have a good time, it would be all right. I have upon other occasions, and at other Associations, mentioned Cleveland. Mr. Lindsley and myself and a good many others belong to the Civil Engineers' Club of Cleveland. They are, like all these Associations, formed for getting good from each other and profiting by exchanging thought. When that club was started, in preparing for the first banquet that we had, the question was: "Shall we have liquor—shall we have wine at the banquet?" and a few said, with determination and positiveness, "No, not if *we* go." And so that has been left out, and we have had meetings now for 5, 6 or 7 years, and a better banquet or better entertainment cannot be had anywhere. Everything goes off in fine style, the entertainment is first-class, but we don't have any wine. Now I know it is not necessary (the wine question, however, is not under discussion, but I am willing to speak of that) to have wine if we have a banquet; and having in view the ability of what might be called smaller towns and cities to provide a banquet, I don't know but it would be well to say that we won't have any, and then we will all stand on the same basis; and any place, where the hotel facilities are such as to accommodate those who can

gather, is free to invite with cordiality this Association to come and see them.

Mr. Wilkiemeyer—Mr. President, I have a resolution to offer on this subject, which I will read:

"*Whereas*, It was the original determination of this Association, as expressed in a resolution unanimously adopted at its meeting for organization in Columbus, Ohio, September, 1884, that the feature of a banquet should not become a concomitant of its annual meetings; and,

"*Whereas*, The tendering of a banquet to our members and visitors in connection with our annual meeting, by local companies in the cities where meetings are held, having, contrary to the expressed determination of our charter members, gradually grown into a custom that might possibly occasion embarrassment in the future, and militate against the best interests of the Association; therefore,

"*Resolved*, That in the future this Association shall decline any tender of a banquet on the part of local companies in the cities in which it shall decide to hold its meetings." [Seconded.]

The President—Gentlemen, you have heard Mr. Wilkiemeyer's resolution. Are there any remarks. This is a matter of some little importance. I think Mr. Wilkiemeyer has put it in tangible shape, and I trust it will be freely discussed.

Mr. Allen—Mr. President, as our town is one of the applicants for the next meeting, it would probably be better for me not to say any thing, but in order to do our Company justice I do want to say one thing. Our Company is not small or niggardly. If Mr. Printz or I should say to them, "We want to have a banquet," they would reply, "Very well, go and have a banquet and we will pay for it." They like to have us attend these conventions, and when anything comes up that they and we consider an advantage to our Gas Company, they say, "Go ahead." Whether we could convince them that a banquet was necessary, or of advantage to our gas works or the gas business in general, I am unable at present to say. If there is anything in it that is doing us any good—were we learning anything that was for our own good directly or indirectly, we would have the "cheek" to say to them we wanted it; and even as it is, if we were to say to them that we wanted it they wouldn't "kick." We ourselves want to stand in as good a light with our Company in the future as we do now, and as when we are away attending these conventions our folks suppose we are looking to their interests, we would not like to shake their confidence.

Mr. McDonald—Mr. President, I being one of the charter members of this Association, have always taken deep interest in its welfare. I am not in favor of places where the Association meetings are held feeling that they have to furnish the Association with a banquet. I have always felt that it would be wrong, and a detriment to the Association, if that were the case; but a resolution of that kind, which says we *will* not accept, to my mind, is not right. I think the banquet matter has been carried too far in many instances. I do not know but that I agree with Mr. Hyde that we could get along just as well without wine. Suppose we went to Zanesville, if you please, or to Cleveland, or to Columbus, and the gentlemen wanted to ask this Association to a social, pleasant time, that might cost $10 or a $100 to the proposers, we would be confronted with the fact that on our books stands a resolution saying we will not accept. That would place the Association in a bad position, I think. I would suggest to the Association that this resolution should be modified to the effect that it shall be dependent upon the vote of the Association at the meeting there and then held.

Mr. Graeff—I think that Mr. McDonald forgets that when he was a young man, and used to go out with one of his best girls, and a girl that would occasionally eat ice cream, and he had to press her occasionally to take some, and she refused, and he would say, "I saw you take some a few evenings ago with some other fellow," then she would go. But if he had a girl that made it a maxim of her life that she wouldn't eat ice cream, she wouldn't go, and he was better off.

Mr. Cantine—I have the honor of belonging to an Association that at its annual reunion follows the policy of paying for its own banquet. It is the custom of all the towns where the reunion is held to provide a hall and all the facilities for having a meeting, but they don't give us a banquet, nor could they do so. Now, you will find that this will militate greatly against this Association after awhile. You will have exhausted all the hospitality there is. This banquet feature will place every company in a bad position. It will, first, have to tender a banquet, then you can decline or accept as you please—you will find there will be no failure to accept—so I think we had better place ourselves on an independent basis. Mr. McDonald represents a big Albany Company and sees no objection to doing these things; but the poverty-stricken gentlemen belonging to this Association find it a little hard on them. Now, in our case, I have told you just how we stand and there would be no hardship. (Laughter.)

Mr. McDonald—I presume it is well known to all the members of this Association that the New England Association always pay for their banquet wherever they are. They always have one at mutual expense. I think $3 per plate is their price. A very moderate amount of wine is furnished at these banquets, and every member feels it no hardship to pay the assessment.

Mr. Wilkiemeyer—The resolution offered does not prevent the Association from furnishing itself a banquet. It can do that.

Mr. McDonald—Suppose a dozen gentlemen in a town should organize and want to give the Association a banquet. Would this prevent the Association from accepting it?

Mr. Wilkiemeyer—The resolu ion says "local companies"—the gas companies. Now, if we go to a manufacturing center where we have half-a-dozen meter manufacturers, we would have no scruple at all about taking a banquet from them.

Mr. McDonald—I am ready to vote for the resolution. (Laughter.)

[The resolution was voted upon and adopted.]

Mr. Penn—Mr. President, I move that the next meeting of the Association be held at Zanesville, Ohio. [Adopted.]

Mr. Printz—I would say to the gentlemen that we have good hotels. Traveling men will confirm what I say in regard to the leading hotel of our place. We have quite a number of places of interest that we will be pleased to show to the members after they have finished their business meeting. I thank you.

Mr. Graef—How is the water there?

Mr. Printz—The water is muddy.

Introducing the New Members.

The President—Gentlemen, as the Secretary calls the list of new members I wish they would be kind enough to rise in their places and answer to their names.

(Thereupon the Secretary called the roll of new members, and as their names were called they rose in their places.)

The President—Gentlemen, I hardly know whether to introduce you to the old members or the old members to the new. I can say we are glad to receive you, and we welcome you to the privileges of the Association of which you are now members, and trust it may be a matter of mutual profit to us all.

(On motion, the meeting adjourned.)

Second Day—Afternoon Session.

QUESTION-BOX.

The President—I think we will open our question-box. The first query is: "*At what point in the works is the best place for the exhauster?*" This is a matter I have heard quite earnestly discussed very recently, and I think we should be able to get some information that perhaps would be of value to us all.

Mr. Hyde—The exhauster at both of the works—the old and the new—at Cleveland, precedes the condensers; that is, it follows right after the retort house.

The President—You interpose no special apparatus between the exhauster and hydraulic main?

Mr. Hyde—At the old works we have a tar extractor or tar scrubber. At the new works there is nothing.

Mr. Evans—We have the exhauster within 30 feet of the hydraulic main—nothing intervening between the exhauster and hydraulic main.

The President—At the works with which I am connected that is substantially the case. We have a tar scrubber in the line between the exhauster and hydraulic, which is the only interposition.

Mr. Hurlburt—In Oberlin we tried it both ways. In the old works we had the exhauster beyond the condenser, and in the new works about 10 feet from the condenser. We don't calculate to have very much tar in our hydraulic mains; only water. It works a great deal better on the new plan than on the old. We have a reservoir in which the tar lodges, and we draw it off from that.

The President—I will inquire of Mr. Hurlburt if he notices any particular difference in the action as to the different points at which it was placed?

Mr. Hurlburt—The difference is in the condition in which we get our gas to the purifier. In using it now next to the hydraulic we have no trouble.

The President—The second question is, "*In a lighting territory covered by illuminating gas and the incandescent electric light, which seems to be in the ascendency?*

Mr. Hyde—At Cleveland gas has the ascendency.

The Secretary—I think that at Columbus, in the territory covered by both our gas and the Edison incandescent electric lights, the gas bills amount to more than the electric light bills.

Mr. Booth—I will ask Mr. Butterworth whether they did not occupy that territory before the electric light company did?

The Secretary—Yes, sir; that would be the case in almost any city that has the incandescent light.

Mr. Penn—I don't think the Edison company is a competitor of the gas company.

Mr. Cantine (addressing the President)—What is the case in your city?

The President—Mr. Hyde has stated the case very fairly, and I don't know that I could add anything to it. The statements he made would perhaps be a little more true on our side of the river than on his. We are the smaller part of the city—a sort of attachment—separated by a geographical line in the shape of a river. I think the electric lighting there is relatively smaller than it is on the other side of the river. In fact, I don't know of an instance of incandescent lighting there, and the population is perhaps 80,000.

Mr. Cantine—My judgment, Mr. President, is that gas is largely in the ascendency in all the smaller towns and cities. In cities with 15,000 or 20,000—at any rate, the smaller cities of 8,000 or 10,000 or 15,000—I think gas will always be in the ascendency, and I doubt whether any company could maintain a plant for any great length of time with the incandescent light solely. They are difficult machines to handle. It is difficult to keep the energy at one thing. As far as some of them are concerned, the cables are so large that it makes the capitalization so great that they can't get their money out of it. I think in the smaller towns few of us have any apprehension of being smothered by the incandescent light. It is true the arc light will be used for lighting streets. It is a large light, and a very brilliant one; but I think there is no apprehension that the electric lamp will hurt us. We have in our town a little opposition, but it is growing less each month. In very many of the business houses they have gone back to gas, until there are only a few now using the electric light.

The President—I will read another question. It is in the same general line, and has been called for by a member who has to leave soon. It is this: "*What system of electric lighting is best for adoption by gas companies?*"

Mr. Penn—I would ask what the question means; whether it means incandescent or arc system, or some particular make of machine.

The President—Manifestly the question is of systems, as between the Edison, the Thomson Houston, the Brush, and Westinghouse. That would be my interpretation of it.

The Secretary—That is mine. It seems to me, Mr. President, that that system which would be best for adoption by an incandescent electric lighting company would also be best for adoption by a gas company; and since Mr. Penn has expressed the opinion that the Edison is hardly to be considered a competitor of gas, it must be some other system than the Edison. We will eliminate that, then.

Mr. Penn—I would say the reason I do not consider the Edison a competitor of the gas company is because it costs too much to install a plant to cover any considerable area. We all understand that—it has been discussed thoroughly before. Of course, other systems come in—the alternating system—which covers a large area, and they can run at a less expense that the Edison. That is the reason why I say the Edison is not a competitor of gas companies. While they give a good light, yet the expense of runing is too great, especially where they have cheap scales, as in Columbus. As far as the other systems are concerned, I found out, when I was investigating as to what system to buy when that competition commenced with us, that they all had the best system—like the woman with the sewing machine. They all have the best sewing machine. It is pretty hard to say which is the best system.

The Secretary—But you would say it would be a high tension system.

Mr. Penn—That is the kind I would buy, if I bought.

The President—The next question is, "*Does a fine gas of 23 to 25-candle power help check the invasion of the incandescent electric light?*" Now, what are the opinions of those who have had experience in that regard? I would suggest that Secretary Butterworth could perhaps give us something on that score.

The Secretary—It would be hard to make a 25-candle power coal gas at Columbus that would not smoke. One would suppose that, theoretically, a high candle power gas would have a tendency to check or retard, in a measure, the invasion of incandescent electric lighting. Yet I have been told that in those cities where the candle power of gas is highest, the incandescent electric light seems to thrive as well as in cities where the candle power of the gas is lower.

Mr. Graeff—I certainly think that a high candle power gas is one of the best means in the world of checking the incandescent electric light.

Secretary Butterworth—How about the progress incandescent electric lighting is making in Baltimore, Mr. Graeff? They have a high candle-power gas there.

Mr. Graeff—I am too good a friend of Frank Hambleton's to answer that question.

Mr. Evans—In my judgment the incandescent electric light has its field just as much as gas has, and there are people in certain manufacturing business, perhaps, or offices, who would pay a larger price for incandescent electric light than they would for gas. Some complain of the heat. Others say the electric light is preferable on account of its convenience—no matches, no danger of fire, touch a button and your light is ready, touch another one and it is out. I know that in Jackson, in trying to win back a very large consumer of the incandescent electric company, they wouldn't have anything to do with gas whatsoever, because a few years ago they had a fire. It is a very large dry goods store, with drapery goods largely, and a few years ago some lace happened to get into the gas flame and ignited, and the loss was some $35,000. They were willing to pay a larger sum for incandescent electric light, and in fact refused to have anything to do with gas whatsoever. I think that condition exists more in large cities than in small cities. I don't think incandescent electric lighting is progressive in small cities at all. In fact I think it is going down hill. But in larger cities, where they can afford to pay for the luxury and convenience of it, I think it is advancing. I know it is in Chicago, and I made a great many inquiries in that direction.

The Secretary—But a high candle power gas would have a tendency to check it, even in large cities.

Mr. Evans—I believe so; yes, sir, with canvassing back of it.

Mr. President—The fourth question is, "*Should we not confine the work of our Association to the important interest it was established to promote, viz., gas lighting and the manufacture of coal gas?*" Now, we have some here who manufacture something besides coal gas. It would seem we ought to be able to bring out some points from this question.

Mr. Hyde—From the reading of this question two constructions could be placed upon it. It says "Gas lighting and manufacture of coal gas." Now, if it had said, "Gas lighting and manufacture of gas," it would be all right; or "coal gas lighting and manufacture of coal gas." As it reads we don't exactly know what the writer intended.

The President—May be that ambiguity was placed there purposely.

The Secretary—The question is ambiguous; but I think the author's idea was that technical light papers, or technical water gas papers should not be encouraged here.

Mr. Hyde—What was the object of this Association? Did it read "Coal gas" or "Water gas?" Was water gas left out?

The Secretary—The constitution simply says "Gas." The object of this Association was to be the "promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction and manufacture of gas works, and to the manufacture, distribution and consumption of illuminating gas, to the end that its cost may be cheapened and its consumption increased."

Mr. Hyde—I would say we ought to do just what this question calls for—confine our work or the work of the Association to the important interests of manufacturing gas. I think that is what we are here for, and I think we should not be talking or discussing anything else than the manufacture of gas and things pertaining to it. We should not discuss railroads, or anything of that kind, but only the manufacture of gas.

The President—The next question has already been partially anticipated. It reads: "*Are cast iron pipes better and cheaper than wrought pipes for gas mains of two to four inches in diameter?*"

The Secretary—A manufacturer of cast iron pipes in Columbus said, when I showed him this question, that he would not recommend a 2-inch cast iron pipe, although he was a cast iron pipe manufacturer; that the tapping of a 2-inch cast iron pipe weakened it, and it was liable to break, etc. Even as to 3 and 4 inch pipes, it was a question with him whether cast was any more durable than wrought.

Mr. Penn—He was not interested in wrought iron?

The Secretary—He is a cast iron pipe manufacturer.

The President—I see Mr. Ranshaw here. In talking with him this morning he gave a little account of some purifying boxes made of sheet metal rather than of cast iron. I wish he would repeat, for the benefit

of the members, what he said to me; and perhaps he can add to that.

Mr. Ranshaw—I alluded to some wrought iron purifying boxes that had been in use not less than 20 years, and which are still in use. They were made out of, I believe, ¼-inch boiler plate—the sides and bottom, if I remember rightly, are three-eighths—and the water seals are made in the ordinary way. These boxes are in use now in the Cumberland gas works. A number of others (smaller ones), 6 and 8 feet, were shipped to different parts of the country.

Mr. Penn—Mr. President, I would ask if wrought iron pipes will not rust out quicker than cast iron from the alkali of the soil? Some soil has more alkali than others. Does not that have an effect upon the wrought iron which it does not have upon the cast?

The President—I think all of us have noticed the difference in the life of wrought pipe according to the soil in which it is placed. For instance, I think Mr. Hyde could give us an account of the very rapid deterioration of pipe laid in a certain locality. We also know that many times a service pipe meets with disaster, and what causes the difference seems almost incomprehensible, but we generally find there is a made soil there—an ingredient in it or something that accounts for the change, if we investigate carefully. The same is true of natural soil, and there is no question that there is a vast difference between a sandy, gravelly soil and a clay soil, with reference to the life of wrought pipe. The life of a cast iron pipe has perhaps hardly been determined in the gas business. Some original pipes are still in the ground and come out all right on latest investigations.

Mr. Penn—What kind of soil is the hardest on pipes, clay or sandy?

The President—Well, my own idea of the thing is that a pipe will last longer in a clay soil, as a rule.

Mr. Penn—That is my experience.

Mr. Hyde—At Cleveland we have had a peculiar experience. At Newburgh, where the rolling mill has been in operation for 30 years, wrought iron service pipes will not last more than a year or so. They are eaten right through. Where there is ashes or coke dust, or pieces of coke, or refuse from a furnace, or anything of that kind, to make contact with the iron, it is very quickly eaten through. At Newburgh, in the eastern part of our city, all the service pipes are now laid in and covered with lime. We take a little trough, put something in it to hold up the pipe, pour it full of water lime, and then plaster it all over so that it is perfectly covered. That preserves it. I don't think I am mistaken in saying otherwise they will not last more than a year until eaten through. Cast iron is not affected that way. I think, as a rule in our city, that we would not wish to use wrought iron pipe of any size for mains. All our services are of wrought iron and, ordinarily in the sand, we experience no particular difficulty; but when we get into some place where ash or coke dust is found, as in Newburgh, we have to protect them. In the ordinary sand they will last apparently an indefinite length of time. We used to lay 2-inch cast iron mains, but it is useless to lay a 2-inch main. It is too small to be tapped. Our smaller mains, as a rule, are 4-inch, and we lay water works weight—a heavy weight—so that we can tap them with impunity. We don't cover our mains—that is, they are not coated with tar.

A Member—Is it not the sulphur that eats through those service pipes?

Mr. Hyde—I think so.

A Member—Wouldn't the use of oxide in your purifiers have the same effect on them that the ashes and stuff would on the service pipes that you speak about? You spoke about your purifiers lasting so long; do you use lime in them?

Mr. Hyde—Yes, sir.

A Member—Any oxide?

Mr. Hyde—No, sir, I think not.

A Member—Well, if you used oxide they wouldn't last any time.

The President—I would like to ask Mr. Hyde if possibly this condition in Newburgh may not be due to the fact that the iron works are located there?

Mr. Hyde—I think the whole atmosphere is filled with this sulphur gas—all the deposits and rain and everything are filled with it. The ground is permeated with these particles of combustion from the coal. One hundred tons of fuel are used every day in the mills at Newburgh.

Mr. Penn—They manufacture copperas, using sulphate of iron?

Mr. Hyde—Yes, sir.

Mr. Penn—That will destroy the iron very rapidly.

Mr. Cantine—Mr. Hyde has spoken about the difficulty of making a good tap in a two-inch main. We find no difficulty whatever in doing that, by the aid of a little device which we use. (Mr. Cantine here described his device.)

The President—I would say that in our experience we have found more difficulty from the fact that the pipe is very much weakened—a three-inch pipe especially. It has been a long time since I have put in anything larger than an inch hole, and I dislike to do that. With the disturbances that come from water and sewer connections and the like, we find that very frequently a three-inch pipe is broken where it is tapped, no matter how thick it is. Even if tapped on the thick side of the pipe, the pipe is liable to be broken. Our 7th question reads, "*Does it pay to coat gas mains with coal tar?*"

Mr. Hyde—We do not think it advisable to coat gas mains—they last long enough anyhow, but there is another objection with reference to coating gas mains. Do not order your mains tarred at the factory where they are made, because if you do you will regret it. You perhaps all know that at the founders where they coat the water mains, they dip them, and that coats the socket and the spigot—the whole main—inside and out. I suppose you all know that the gas puts the tar coating in such a condition that it will run. It finally is disintegrated, runs down into the bo tom of the mains and flows on as far as it can and stops up everything. More than that, in pouring a lead joint, the hot lead melts the tar and the tar rises or comes to the top. The last lead that enters the socket holds that tar there—it is not simply a thin coating at the upper part of the bowl, but a thick quantity—the joint is driven up, and after a space of time, say six months or a year, the gas operates on that tar, liquefies it, and it runs out, and you then have an open joint. We had a most unfortunate experience of this kind. We laid a 24-inch main and a 16-inch main that way, and I suppose in the course of two years every joint had to be made over or caulked up. We had to dig down and cut the tar out, and then drive the joints up again? Through 1½ miles of 24-inch pipe, and two or three miles of 16-inch pipe, I suppose every joint has been gone over the second time; and we thought it of so much consequence that in speaking with foundry men we say, "Don't ever dip a pipe for a gas main. If he orders a pipe dipped, tell him you will not do it, because if he is not posted he will get posted before he gets through with it, and you had better post him beforehand." We have taken some pains to advise foundry men not to dip pipe for gas men. Perhaps you all know about this, but if you don't, you had better regard it, or you will have experience that you will regret. We have had all we want of it.

Mr. Penn—I would like to ask if that applies to wrought iron pipes?

Mr. Hyde—It does not apply to wrought, because wrought iron is made with a thread.

Mr. Penn—I mean without coating on the outside. Will they last forever, like cast iron?

Mr. Hyde—No, sir; the wrought iron pipe ought to be coated. A mixture of red and white lead, I suppose, would be the best of anything. That seems to be indestructible and everlasting.

The President—What Mr. Hyde has stated with reference to the joints of tar-coated cast iron pipe I can indorse as true and worthy of the most careful consideration. Our Company has not so extended an experience as Mr. Hyde's people, but we have had all we want. On one occasion we had to put in some tar-coated pipe. We did not cut out, as Mr. Hyde describes, the joints in the first instance—that is, the upper part of the joints, where there is a kind of spongy mixture, more or less lead and tar. As it boils up there it forms a kind of porous condition of the lead, and you may caulk it up and within a year you must do it again; and if it were not cut out it would keep on doing that.

Mr. Hyde—I did not say we cut it out; we drove it up.

The President—Did not you find it necessary to take something out there?

Mr. Hyde—No, sir; we drove it up. We have latterly driven a heavy chisel in. We find it easy to do, and put a big wedge into the top of every single one of these pipes. Whenever we open them now we resort to that as a means of saving another opening.

(To be continued.)

Public Street Lighting in New York.

E. G. Love, Ph. D., Gas Examiner for this city, recently prepared the following interesting paper on this subject for the *School of Mines Quarterly*. Doctor Love wrote:

The first attempt to light the public streets of New York with gas was made in 1823, when a contract was executed with the newly organized New York Gas Light Company. The contract granted to the Company the exclusive privilege, for a term of 30 years, of supplying gas to that portion of the city lying south of Grand street. The cost of each public lamp was not to exceed the amount paid for 1 oil lamp. This contract expired by limitation in 1853, and another one was made for a period of

1 year. It was similar to the first, except that the exclusive right to the territory below Grand street was omitted, and the price to be paid for lighting the lamps was fixed at $15.47 each per annum for 2,300 hours, with a corresponding increase in price for any extension in the number of hours.

The practice up to this time had been not to light the lamps on moonlight nights, but late in 1853 the Common Council directed that the public lamps should be lighted on every night of the year. This increased the number of hours of lighting to 3,833, and the cost of each lamp to about $25 per annum. The number of hours lighting remained at the figure given until 1879, when it was increased to 4,000, and has been without change up to the present time.

Some 10 years after the introduction of gas lamps in the city, the Manhattan Gas Light Company was organized, and in 1833 obtained a grant and contract to light that portion of the city lying between Grand street and Sixth street, the same to continue for 20 years.

Owing to the rapid growth of the city, an extension of the lighting system became necessary. To this end the existing contract with the Manhattan Company was cancelled in 1848, and another one made for a period of 20 years, in which the territory was extended to Forty-second street. As in the former contract, the price per lamp was fixed at $15 per annum for 2,300 lighting hours, or $25 for 3,833 hours. This second contract was cancelled by mutual consent in 1865, and for the 8 years following the city's streets were lighted under short contracts or none at all. During most of this period the gas companies, profiting by a decision of the Court of Appeals, charged $53 per lamp per annum.

In the years 1855, 1858 and 1868, the Harlem, the Metropolitan and the Mutual Gas Companies, respectively, entered the field, already sufficiently well filled, and received their grants to tear up the city's streets, under the mistaken idea that an increase in the number of companies and the amount of capital invested would give the consumer cheaper gas.

The amended city charter of 1873 authorized "the Commissioner of Public Works, in conjunction with the Mayor and Comptroller" (commonly known as the Gas Commission), to make contracts for lighting the streets, avenues and places of the city with gas, but limited the contracts to 1 year. Under this Act contracts were made for the year 1874 at greatly reduced rates, which have continued up to the present time.

For convenience in connecting the public lamps with the gas mains, the Gas Commission was authorized in 1878 to determine when the year for the lighting contracts should commence, so that now all contracts for lighting the public lamps date from May 1st to the April 30th following.

The contract prices in 1888 were $17.50 per lamp by the Consolidated and Mutual Companies, and $12 by the Equitable Company. In the case of the latter Company, the franchise fixes the price given as a maximum. Companies lighting the public street lamps beyond Harlem river receive $28 and $29 per lamp.

The first movement looking to the public lighting of New York by the electric light was a resolution adopted by the Common Council in February, 1879, requesting the Gas Commission "to have experiments made to test the practicability of lighting" the streets and parks of the city with the electric light, and to determine the relative cost of gas and electricity for this purpose. As the experiments were to be made without expense to the city, nothing was done under the resolution.

Early in November, 1880, however, the Brush Electric Light Company asked permission to erect lamp posts on Broadway, from Fourteenth street to Thirty-fourth street, for the purpose of demonstrating the suitability of the electric light for street illumination. This request was granted, and on the 15th of January following 22 arc lamps were lighted by the Company, and continued without expense to the city until the 1st of June. While these lamps were far from perfect, the experiment promised sufficiently well to warrant the Gas Commission in making a contract with the Brush Company. Fifty-five lamps were lighted under this contract, at the rate of $7,400 per annum.

Another contract was made with the Brush Company for 1882, and also one with the United States Electric Illuminating Company. The price paid by the city was 70 cents per lamp per night, or $255.50 per annum. This continued to be the price up to May 1, 1887, the number of lamps being increased each year. Thus, on the 31st of December, 1882, there were 128 electric arc lamps in use; in 1884, 647 lamps; in 1886, 711 lamps; and in 1888, 1,328 lamps.

Previous to 1887 the contracts were awarded to the two companies already mentioned; but a number of new companies now entered the field, and the contract price in 1887 varied from 19.9 cents to 50 cents per lamp per night. The prices paid in 1888 varied from 32 cents to 60 cents per lamp per night, the average being 35.2 cents.

To arrive at the comparative cost of gas and electric light for street illumination we may take the years 1885 and 1888—in the former the price being 70 cents per lamp per night, while in the latter it averaged 35.2 cents.

The number of gas lamps replaced by each electric light will naturally be subject to some variation, but the average, based upon the introduction of a large number of electric lights, is 4½ gas lamps for each electric lamp. At the close of 1885 there were 708 electric lamps in use, equivalent to 3,185 gas lamps. The cost of the electric lamps at $255.50 each, on the supposition that no reductions were made for extinguishments, would have been $180,894. The price paid for the gas lamps replaced was $17.50 each per annum, and if to this we add $1.60 for supplies, etc., we obtain $19.10 as the cost of each gas lamp, or $60,852.60 for the total number of lamps replaced. The lighting by electric lamps, therefore, cost $120,041.40, or 66 per cent. more than would have been paid for the less brilliant illumination by gas.

On the 31st of December, 1888, there were 1,328 electric lamps in use, at the average price of $128.48 per annum, or a total cost of $170,621.44. They replaced 5,976 gas lamps, costing, with supplies, etc., $19.14 each per year, or a total cost of $114,380.64. In this case, where the prices charged for both gas and electric lamps were about as low as we may expect to see them—for the present at least—the excess in cost of the electric lamps over the gas lamps was $56,240.80, or about 33 per cent. It is therefore apparent that whatever may be the advantages of the electric light over the ordinary gas lamp for street illumination, we are obliged to pay liberally for these advantages; and it becomes a question to what extent it is desirable to replace gas lamps by the more intense but less reliable electric lamps at an increase of one third in cost.

As showing the demand for this greater illumination, it is interesting to note that in 1885 the Common Council passed various resolutions requesting the Gas Commission to light certain streets and avenues with the electric light. The Superintendent of Lamps and Gas estimated that had it been possible to comply with these requests it would have taken over 2,000 lamps, costing $526,840, and have replaced gas lamps costing $89,862.50; an excess in cost of the electric light over the gas lamps of $436,977.50—more than one-half of the entire appropriation for public lighting.

As regards comparative illumination, it is not necessary to say that the electric light is much superior to gas; indeed, in New York the street lighting by gas is not what it ought to be. The first contract made with the New York Gas Light Company, in 1823, specified the burner to be used as one capable of passing 3 feet of gas per hour; and while repeated efforts have been made to increase the capacity of the burner to 4, 5, or 6 feet per hour, we are, in this respect, precisely where we were more than 60 years ago. And yet during this period the candle power of the gas supplied has been nearly doubled; so that to-day our street lamps give a light of from 10 to 16 candles for 3 feet of gas.

In the early days of electric lighting it was commonly said that the ordinary arc lamp gave a light of 2,000 candles, but such is not and it never has been the case. The arc lamp gives less light horizontally than in a downward direction, and when these lamps were first put upon the market some one measured, or, more probably, estimated the intensity in a horizontal direction at 500 candles, and then, to make a good showing, multiplied it by 4, making the 2,000 candles. While the 500 candles was pretty clever guessing, there was no good reason whatever for multiplying it by 4 any more than by 360.

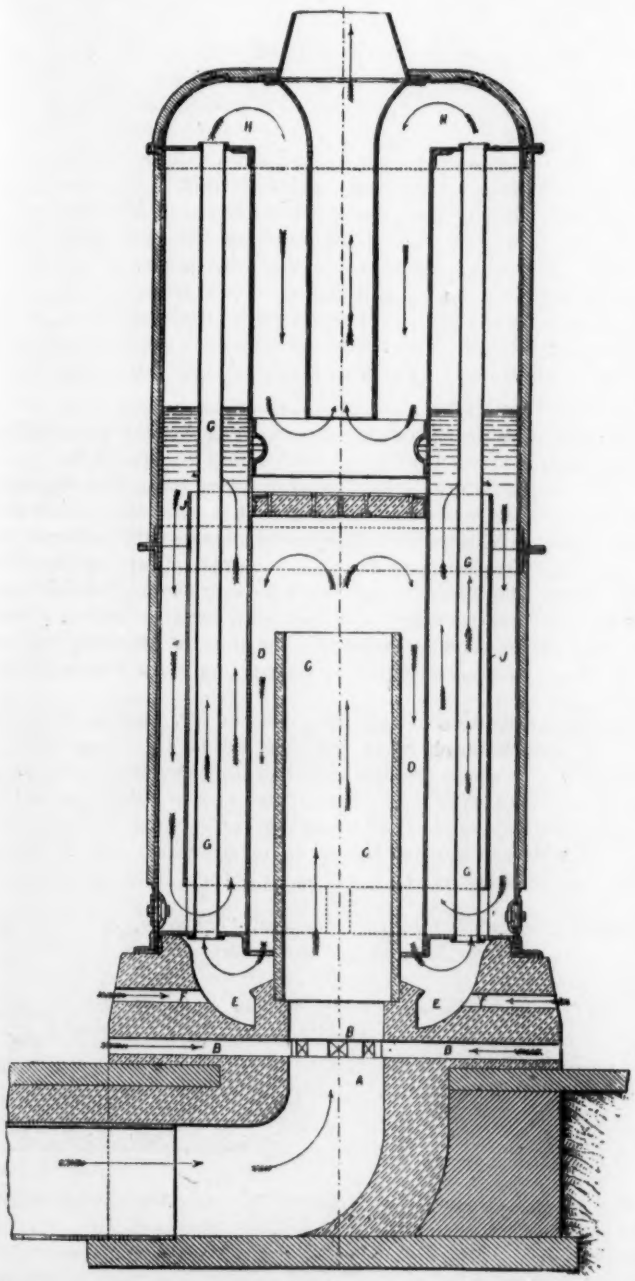
As the amount of light thrown upon the walk and roadway is of more importance than that emitted in a horizontal direction, the present city contracts with the electric light companies require that the lamps shall give a light of at least 1,000 candles at an angle of 40° below the horizontal. Measurements which have been made of the lamps of some of the companies give from 1,300 to 500 candles.

Of late an attempt has been made by one of the gas companies to introduce a large regenerative gas burner—the Gordon—for street illumination. It has been tried on parts of Fifth and Madison avenues, and Forty-ninth and Fiftieth streets, with very satisfactory results, and without expense to the city. An arrangement was made to light Lenox avenue, from One Hundred and Tenth street to One Hundred and Twenty-ninth street, with 75 of these lamps, during the month of December. The expense of this installation, however, which is $5 per lamp per month, will doubtless prevent its extension.

The recent extinguishing of most of the electric lamps, and the consequent darkness on many of our thoroughfares, calls public attention especially to this subject of street lighting, and shows the importance of keeping the gas lamps in a condition for immediate use, certainly until the electric light has become more thoroughly domesticated.

Thwaite's Gas Fired Boiler.

The boiler herewith illustrated is being introduced by the Gaseous and Liquid Fuel Supply Company, of Liverpool, Eng., and is the invention of Mr. B. H. Thwaite. The cut shows a 30-horse power steam generator designed to be heated with gaseous fuel, such as producer gas. The gaseous fuel is generated in a Thwaite gas generator, but the latter can be placed immediately below the steam generator. Where there is a series of these boilers it is advantageous to generate the gas in separate vessels.



The gas ascends into a vertical combustion chamber *A*, meeting a supply of air issuing radially and uniformly from air tubes *B*, at the level of which combustion ensues, the flame flowing upward inside refractory tube *C*, which becomes heated to bright incandescence. The flame passes over the upper edges of this combustion tube *C*, and descends the annular space *D* formed between the flue plate and tube, the ring of flame being in close contact to the water-covered surface of tube. The combustion is completed in the annular chamber *E*, which is provided with a secondary air supply by means of the radially-placed air tubes *F*. The gaseous products of combustion ascend through the tubular part of the generator *G* into the upper chamber *H*, when they are diverted and directed downward around the inverted tube *I*, around which they circulate in contact with the steam-covered surface of the boiler flue plate, superheating the steam and enabling the full practicable absorption of the sensible heat from the gases of combustion to be obtained. The arrows clearly show the direction of flow of gases to the chimney.

It will be seen that the maximum temperature and the flame combustion is next to the water-covered surfaces, only the products of combustion with their sensible heat being next to the steam-containing portion of the generator. It will also be noticed that practically all the heating surface is vertical. The circulating arrangement of this generator is most simple and effective. An annular ring or curtain *J* is provided, dividing the ascending and descending currents. The latter flow next to the outer casing, sweeping the tube-plate and flowing with great velocity over the surface of the combustion flue. The velocity of circulation is such as to prevent the deposition of any calcareous material, all that is required to maintain the internal heating surfaces free from scale is to blow off the boiler once a week. The perfection of combustion enables the boiler to work without the necessity of cleaning the tubes. The rate of evaporation can be maintained almost absolutely constant. The boiler is provided with Heffner's safety Popp valve, which was tested at various pressures up to 95 pounds to the square inch in this boiler, and gave satisfactory results.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Hoosick Falls (N. Y.) Gas Light Company have determined to reduce the net selling rate to $2 per 1,000 cubic feet.

AT the annual meeting of the Royal Electric Company, of Montreal, Canada, the following officers were elected: President, Hon. J. R. Thibaudeau; Vice-President, W. J. Withall; Directors, the officers and Messrs. G. R. Robertson, E. A. Small, J. A. Strathy, W. Cassils and F. L. Beique. While the financial reports submitted were "generally considered satisfactory," we have it on good authority that the balance sheet shows no evidence of very pronounced earnings. Further, it would be rather strange if it did, since the local Gas Company's good and cheap gas seems to be in great favor with the residents, even though the city authorities are willing to strain a point—if not more—in favor of aiding and abetting the electricians in respect to the public lighting.

WE are informed that the Cincinnati Gas Light and Coke Company has arranged for the construction of a large gasholder, to be located at the corner of McMillan and Church streets, in the Walnut Hills district

A SUIT that is attracting considerable attention in Philadelphia is one brought in the local Court of Common Pleas, (No. 2), by A. H. McNeal, the pipe founder of Burlington, N. J., against the Director of Public Works (Gen. Wagner) for $50,000 damages "for defamation of character and injury to complainants business reputation and credit." The suit, according to our local advices, is based upon a remark said to have been made by Director Wagner when, on the fifth of last November, he rejected a bid for gas pipe tendered by McNeal. This particular bid was considerably lower than that of any other tender submitted in the competition, and when it was opened the Director ordered that it be thrown aside, at the same time remarking, "This bid will not be considered, because this man McNeal has committed a criminal offence in altering a city contract which was awarded him some time ago." Our authority then goes on to say: "In explanation of what the Director meant, Richard P. White, counsel for Mr. McNeal, says that on March 5th, 1889, McNeal was the lowest bidder, by several thousand dollars, on a very large contract for gas pipe, the task of delivering which was to commence at once, and to be completed on the 1st of July following, under a forfeiture for delay. The contract was awarded to Mr. McNeal, who was notified by Chief Engineer Park, on the 7th of March, of the award. He answered at once that he was ready, but would not furnish any pipe until the contract had been signed. He wrote repeatedly to urge the preparation of the contract papers and finally, after they had been delayed over two weeks, he notified Director Wagner that he would not sign the contract unless there was included in it a provision extending the time for the delivery of the pipe for as long a time as the papers had been delayed, or for a release of the forfeiture. The Law Department, at the close of the month sent him a blank form of contract, before signing which Mr. McNeal inserted the clause upon which he insisted. The form thus signed, but unsigned by any one else, was returned to the Department of Public Works. Director Wagner refused to sign it with the clause inserted by McNeal, and ordered the pipe from the firm of R. D. Wood & Co., under a contract to have the pipe delivered by November 15, at a cost said to be $2,005.29 more than the same pipe would have been delivered by McNeal, before August 1, if the Director had allowed McNeal for the delay claimed. Of course, it must be remembered that the foregoing is but a reflex of the opinion of Mr. McNeal's attorney, and take it all-in-all, I fail to see wherein the

Director has not the best of the thing all the way through in the matter of a plain business proposition, for I fail to see where Mr. McNeal could justly think himself entitled to alter a contract, the specifications of which were under the framing of the city authorities. At this point, however, one must cease to defend General Wagner, in so far as anything detailed above can be construed in excuse of the remark attributed to the General, that McNeal had committed a criminal offence. It, however, is but another instance of how far an irascible temper may embroil a man; and it may be taken for granted that Director Wagner is not over-choice sometimes in choosing words expressive of his dissent. I might be forgiven, too, for remarking that it is almost time he arrived at the knowledge that the language of the camp is not best suited for the expression of a business verdict.—QUAKER."

FIFTY new passenger coaches, to be lighted by the Pintsch system of compressed oil gas, have been contracted for by the New York Central & Hudson R. R. R. Co., to be delivered at an early day.

IT is probable that Manchester, Va., will be lighted with gas in a few months. In any event, the scheme for the construction of a gas plant there has been revived, and one of those most prominently identified with the resurrection is Mr. John C. Robertson, General Manager of the Southside Land and Improvement Company.

THE Paterson (N. J.) resident whose monthly consumption of gas aggregates 5,000 cubic feet or upwards is to be granted a certain rebate from the present net price. The Gas Company will also institute a system for the regular inspection of consumer's burners, fixtures, etc.

THE proprietors of the Kansas City (Mo.) Gas Light and Coke Company have filed plans for the construction of a brick, boiler and engine house, to be located at 25th street and "State Line," the estimated cost of which is $40,000.

THE residents of Everett, Mass., are clamoring for the right to operate an electric lighting plant on town account. They now pay $90 per annum each for arc lights, and $18 for incandescents (16-candle power), on a lighting table (moon-schedule) that ends at midnight.

THE Gas Lamp Committee, at a recent meeting of the Wilkes-Barre, Pa., City Council, submitted a resolution providing for the abandonment of all public electric lights, and the substituting therefor of gas and naphtha lamps. This proposition created quite a stir in the meeting room, and Mr. McCartney was quite pronounced in opposition to the measure. He thought that Wilkes-Barre would be disgraced in the event of its casting out electricity, and that no Alderman could give any good reason why such a course should be adopted. Mr. Lavin thought that Wilkes-Barre could not afford to bankrupt itself for the sake of maintaining electric lighting; and that the present system was decidedly inefficient. Again, if the system was to be followed it would have to be extended, since it would not do to make fish of the residents of one Ward and flesh of those in another. Mr. Long, on behalf of the electric light suppliers, said the rates charged were not excessive, and that the service was fully up to standard. Mr. Mahoney thought the city ought to be equally well lit in all of its divisions, and was decidedly opposed to having electric lights in one Ward and naphtha lights in another. He thought that an improved system of gas lighting would be acceptable to the citizens; not only so, but that it would be far cheaper than the present hybrid plan. Mr. Lavin said that under the present conditions one-third of the city absorbed three-fourths of the lighting appropriation. When the debate was closed, by means of a motion to lay the report on the table, the latter was determined on by a vote of 10 to 9. A pretty close shave for the electricians; but not so close as they may look forward to in the near future.

ALTHOUGH the figures would indicate something of the imposing order, we imagine there is more of buncombe in them than of real value, which opinion is advanced in connection with the suit of Col. James M. Clark, who asks for the appointment of a receiver for the Michigan Gas Company (nominal headquarters at Detroit), in a suit begun in the Circuit Court. For the transfer of Ohio rights and the franchise for the right to use the streets of Detroit he alleges that the Company was to give him $30,000 and one-sixth of its stock. As they are said to have transferred $2,500,000 in stock to the Interior Construction Company, he wants the matter looked into.

ACCORDING to the Indianapolis (Ind.) *Journal*, the Electric Lighting and Gas Heating and Illuminating Company, of that city, has filed notice with the Secretary of State of its intention to extend and enlarge the objects of the Company, so as to include the business of mining, drilling, sinking and operating wells for natural gas, petroleum and minerals. This Company, which is the successor of the three corporations that recently operated the Indianapolis Gas Light and Coke, the Citizens and the Natural Gas Companies, is incorporated by Messrs. C. E. Benedict, Chas. F. Dieterich, E. J. Jerzmanowski (New York), and Messrs. Henry Decker, S. W. Pray and H. E. Pickett, of Indianapolis. The *Journal* intimates that Mr. Pray will be appointed Secretary, that Mr. Decker will act as Cashier, and that Mr. Pickett will act as General Manager of the natural gas plant.

A "VOTER," in writing to the Rutland (Vt.) *Herald*, says: "Below is a sample of how villages are deceived regarding the cost of putting in electric light plants, to be operated on municipal account, and Bangor (Me.) is selected as the instance. Its city charter enables it to use certain water power. Assuming this power to be sufficient, an estimate was made of $17,000 to equip the city with a plant of its own, and afterwards $3,000 was added for contingencies, whereupon the city committed itself to the scheme. The lowest bid received, however, was reported at $26,000. The water power was found inadequate, requiring a steam plant in addition, costing $5,000, and an additional $10,000 is now required to make the plant answer the city's needs, or in all, $41,000, as against the estimate of $20,000 on which action was first based. Do the taxpayers of Rutland want to be burdened with more taxes for a wild scheme of this kind?"

REFERRING to the opinion of Assistant Corporation Counsel Darrow, of Chicago, in respect to the right of the city to regulate the price to be charged for gas by the various gas companies doing business there, it is found that his adverse decision rests on the basis that, while the City Council would without doubt have power to prescribe by any ordinance, giving to any gas company the right to use the streets, terms and conditions upon which such right could be exercised, it would not have power to control the charges of gas companies to private individuals when no conditions were imposed at the time of granting the right to said companies to occupy and lay their mains in the streets.

WE are called on to record the death of Mr. Thomas Earle, at one time a prominent figure in business circles in Jersey City, N. J. Deceased, who was in his 91st year, had for years acted as President of the Jersey City Gas Light Company, and when in control of its fortunes managed them judiciously. He had been City Treasurer for 15 years, and had been a member of the Board of Aldermen for 10 years. He was also Vice-President of the Hudson County National Bank.

THE Philadelphia Gas Improvement Company, of which W. L. Elkins, Jr., is President, is the corporation that is interested in the recent grant for a works to supply gas in the suburban Chicago towns of Cicero, Oak Park, Harlem and Austin. A plant with a capacity of 1,000,000 cubic feet per day is talked of; but this is probably a trifle, if not more, in excess of the real mark.

THE Iron City Gas Light Company (capital, $5,000) has been incorporated at Pittsburgh by Messrs. J. B. Griggs, W. M. Cooper, J. M. King, H. L. Trees and J. H. Young.

THE proprietors of the Brattleboro (Vt.) Gas Company have decided to add a 650-light Thomson-House incandescent type dynamo to their present arc lighting outfit.

THE 2 per cent. dividend declared by the Citizens Gas Light Company, of Wakefield, Mass., is now payable.

MR. LINCOLN HAMMETT has resigned the position of Superintendent of the Warren (R. I.) Gas and Electric Light Company.

THE plant addition to generating house of the Spencer (Mass.) Gas Company, now in process of construction, will enable the Company to deliver 40,000 cubic feet of gas per diem.

AT the annual meeting of the Consumers Gas Company of Newburgh, N. Y., the following Board of Directors was chosen: Joseph H. Berry, Detroit, Mich.; O. H. Lawrence, Fitchburg, Mass.; and Capt. John C. Adams, Isaac L. Corwin, and Benj. McDonald, of Newburg.

THE offices of the Birmingham (Ala.) Gas, Electric Light and Power Company have been removed to 1805 Second avenue, which change will greatly tend to the convenience of its customers.

OWING the large increase in its business, the Berlin Iron Bridge Company, of East Berlin, Conn., has made important changes, both in the instance of its officers and in the details of its business. Mr. Burr K. Field, who had served it as Vice-President and Treasurer, resigned the latter office, and Mr. F. L. Wilcox, of Berlin, was named to the vacancy. The new Treasurer was formerly Manager of the Kensington factories of the Peck, Stow & Wilcox Company, and is well and favorably known throughout New England as a brisk and safe financier. Mr. Field will devote his entire attention to the constructing department, which has of late years assumed very large proportions—its sales last year amounted to almost a million of dollars. All the other departments will, as heretofore, be under the direct supervision of the President and Chief Engineer, Mr. Charles M. Jarvis, ably assisted by Mr. Mace Moulton as Consulting Engineer, and Mr. S. W. Bowles, Jr., as Superintending Engineer. The Company's specialty, in which gas men are most interested, is its improved system of iron roofs for retort houses, etc.

THE Directors of the Lowell (Mass.) Gas Light Company have chosen Mr. George W. Farhnam to succeed the late Oliver E. Cushing as Agent. This appointment is one that does credit to the proprietors of the Company, in that it is the promotion of a man who has for years faithfully served the corporation in lesser capacities. That he will fill the bill is beyond doubt, for everything committed to his care in the past was completed in honest fashion. We congratulate Mr. Farnham, and the Company, too.

MR. J. L. HALLETT, of Springfield, Mass., is on his way home from a few weeks outing, chiefly spent in Colorado and California. He is in robust health, is as bright as a button, and will soon be heard from again in connection with the gas business.

MR. E. A. VAN HORNE has been elected Superintendent of the Oswego (N. Y.) Gas Light Company.

THE proprietors of the Whitehall (N. Y.) Gas Company have leased the old Martin sawmill with the intention of installing therein an electric lighting plant.

THE Wilkes-Barre (Pa.) Council, at a special meeting held to consider the matter of awarding a street lighting contract—mention of earlier action in the premises will be found elsewhere in these columns—rejected the proposition to abandon electric lighting, and substitute gas therefor. A compromise resolution was agreed to under which the city will maintain 49 arc lights, at the rate of $135 each per annum, and 180 or more gas lamps, to cost $20 per annum each. This is a reduction of $4.50 per annum on each electric light from the last contract rate; the gas rate remaining substantially the same. The contract is to run for a year, from first inst.

FROM a Montreal correspondent we have the following: "The annual meeting of the Gas Company was held on the afternoon of the 3d inst., and was largely attended. President Jesse Joseph occupied the chair, flanked by his astute understudy, Manager J. F. Scriver. The reports, which show how prosperous the Company is, were read and accepted, after which Mr. Joseph submitted to the shareholders a proposition to issue $500,000 of new stock, and a resolution to that effect was unanimously adopted. The stock is to be called at the discretion of the Directors, and quite likely one-half will be emitted now, the other half to be called towards the close of the summer. This issue will bring the company's capital account to $2,500,000, and the proceeds of the sale of the new stock will go to meet the loans made in improving the property and increasing the plant capacity during the last six years. The most important business, however, that was transacted was an announcement that from and after May first the price of gas was to rule at $1.40 per 1,000 cubic feet. The retiring Directors were re-elected by acclamation. In conclusion, I might remark that the meeting was a most harmonious one."

"DEAR *Journal*:—About the most extraordinary thing in connection with current events in New England gas politics is an application for the incorporation of an opposition gas company at Marlboro, Mass., which town is, in all sincerity, just about big enough to enable the present Company to exist. Marlboro's citizens are a not over-liberal set, and I have no doubt that they can tell to a mill just what the value of a penny is. Under the circumstances, then, if the citizens happened to be the only factor in the case, it might be a good thing to advocate the licensing of the opposition company in order that the citizens might be called on eventually to pay the cost of the fight. On the other hand we are confronted with the fact that as the old Marlboro Company has kept its promises it should be protected. This is where the State Commission will have a chance to show its capacity for protecting invested capital from the attacks of malice; and it is quite an open secret that the opposition attack at Marlboro has its inspiration—well, not from any desire to benefit Marlboro's mill-counters. The putative officers of the new company are: President, Hon. W. N. Davenport; Treasurer, E. L. Bigelow; Clerk, Frank Wall. Another bit of news is that the Springfield Company is likely to lose the lighting of the engine houses. The electricians are willing to do the work for $800 per annum, as against the Gas Company's charge of $1,300. The light-of-the-future suppliers say that 20 incandescent lamps of 16-candle power each will amply light each engine house—there are 8 of these in the city—but I am inclined to think that at least 24 lamps of this power would be required to light the houses with anything like a satisfactory result.—OBSERVER."

IT is pretty well understood that General Hickenlooper has so managed it that all the electric lighting enterprises in Cincinnati—save, possibly, the Queen City Company—are under control of the Cincinnati Gas Light and Coke Company. The names of the electric companies absorbed are: The Cincinnati Electric Light Company, the Brush, the Cincinnati Electric Light and Power Company, the Thomson-Houston, the First Edison, and the Edison General Electric Company. It is needless to say that the General dictated the terms.

THE Pottstown (Pa.) Light, Heat and Power Company has been awarded a contract for the public lighting of that place, arc lights to be employed. The contract is to run for three years.

THE Municipal Electric Light Company, which has the contract for the public lighting of St. Louis, expects to begin service under the agreement on or before the 21st.

THE conference committees from the Troy (N. Y.) Gas Company and the Troy Electric Light Company, appointed for the purpose of agreeing, if possible, on a rate or sum for the transfer of the property of the latter to the former, have been unable to solve the problem. It is reasonable to assert, however, that an agreement will finally be reached.

THE authorities of Stockton, Cal., and the local Gas Light and Heat Company have settled their differences in respect to a contract for the public lighting, which is of the electric type. The rate agreed on is $13.75 per month for each arc burning on moon-table; also, the city to pay 7 cents per hour for each light that is kept burning any time in excess of the hours provided for in the schedule.

OUT of a total of 9,629 meters inspected last year by the Government of Canada, only 198 ((or 2 per cent.) were rejected as outside the correct limit in respect to fast measurement. On the other hand, those reported slow were returned at 5.8 per cent.

THE street gamins of New Albany, Ind., have been amusing themselves so greatly of late in smashing the glasses of the gas lamps in that city that Superintendent Dunbar has been obliged to offer a reward that will lead to the conviction of any of the offenders.

MR. W. W. DASHIELL, has resigned from the service of the Bayonne and Greenville (N. J.) Gas Company to accept an important position with an extensive manufacturing establishment in Birmingham, Ala.

IT is likely that the Annapolis (Md.) Gas Company will build a new works.

THE offices of the East Chester (Mt. Vernon, N. Y.) Gas Company have been removed to the Cardner Building, First street and Third avenue.

MAYOR NELMES has signed a 5-year contract with the Atlanta (Ga.) Gas Company under which the latter is to put up and maintain 50 gas street lamps in the suburb known as the "West End."

AT a recent meeting of the Directors of the Bristol (Pa.) Gas Company it was ordered that the price of gas be reduced from $2 to $1.60 per 1,000 cubic feet, the new schedule to take effect on May 1st. This looks like business. The Bristol folks will also make a determined effort to popularize the use of gas for cooking.

THE Scranton (Pa.) Gas Company is improving its system of distribution, especially on the Main street division.

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PROPRIETORS.

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AGENTS.
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MONDAY, APRIL 14, 1890.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.
16 WALL ST., NEW YORK CITY.
APRIL 14.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	96½	97
Central	500,000	50	85	95
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	117	119
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	120
Mutual	3,500,000	100	109	112
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	45
Preferred	5,000,000	100	84	87
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	109	112
Citizens	1,200,000	20	—	68
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	124	126
" Bonds	300,000		100	105
Peoples	1,000,000	10	80	82
" Bonds (5's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	96	—
Nassau	1,000,000	25	120	—
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	123	125
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	23½	25
Income Bonds	2,000,000	1000	—	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	45¼	45½
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	93¾	94
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	94⅞	95½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	96	100
Consumers Gas Light Co., Jersey City	2,000,000	100	15	25
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	48½	48⅝
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	75	90
Bonds	250,000		—	—
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	186	190
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	12	16
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	82	82⅞
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			35	35½
Peoples, Jersey City		—	60	61
" " Bonds.			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	99	100
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	55½	55¾
Washington, D. C.	2,000,000	20	200	208
Wilmington, Del.		50	88	90

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 540
Wm. Henry White, New York City ... 543
Wm. Mooney, New York City ... 540
William Gardner, Pittsburgh, Pa ... 540
Fred. Bredel, N. Y. City ... 539

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 543
Continental Iron Works. Greenpoint, L. I ... 543
Deily & Fowler, Phila., Pa ... 543
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 531
Stacey Mfg. Co., Cincinnati, Ohio ... 543
Bartlett, Hayward & Co., Baltimore, Md ... 541
Morris, Tasker & Co., Limited, Phila., Pa ... 541
Davis & Farnum Mfg. Co., Waltham, Mass ... 531
R. D. Wood & Co., Phila., Pa ... 542
Bouton Foundry Co., Chicago, Ills ... 543
Smith & Sayre Manufacturing Co., New York City ... 542
Fred. Bredel, N. Y. City ... 539
United Gas Improvement Co., Phila., Pa ... 533
National Gas Light and Fuel Co., Chicago, Ills ... 530
Simpkin & Hillyer, Richmond, Va ... 527

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa ... 540
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 540
Ohio Pipe Co., Columbus, Ohio ... 540
M. J. Drummond, New York City ... 540
R. D. Wood & Co., Phila., Pa ... 542
Warren Foundry & Machine Co., New York City ... 540
Donaldson Iron Co., Emaus, Pa ... 540
Dennis Long & Company, Louisville, Ky ... 540

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 530
Bartlett, Hayward & Co., Baltimore, Md ... 541
Wm. Henry White, N. Y. City ... 543
United Gas Improvement Co., Phila., Pa ... 533
The Fuel Gas and Light Improvement Co., N. Y. City ... 528

INCLINED RETORTS.

Laclede Fire Brick Manuf'g Co., St, Louis, Mo ... 495

GASHOLDER TANKS.

W. C. Whyte, New York City ... 530
J. P. Whittier, Brooklyn, N. Y ... 535

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 528

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 538
B. Kreischer & Sons, New York City ... 538
Adam Weber, New York City ... 538
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 538
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 538
Borgner & O'Brien, Phila., Pa ... 538
James Gardner, Jr., Pittsburgh, Pa ... 538
Henry Maurer & Son, New York city ... 539
Chicago Retort and Fire Brick Co., Chicago, Ills ... 538
Baltimore Retort and Fire Brick Co., Baltimore ... 538
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 538
Boston Fire Brick Works, Boston, Mass ... 538

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 496
R. D. Wood & Co., Phila., Pa ... 542

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 541
Fred. Bredel, New York City ... 539
Chicago Retort and Firebrick Co., Chicago, Ills ... 538
Wm. Henry White, N. Y. City ... 543
J. H. Gautier & Co., Jersey City, N. J ... 539

GAS GOVERNORS.

Connelly & Co., New York City ... 535
Fred. Bredel, N. Y. City ... 539
Friedrich Lux, London, England ... 527

SELF-SEALING MOUTHPIECE DOORS.

Smith & Sayre Mfg. Co., New York City ... 542

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 532

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 538

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 544

GAS METERS.

John J. Griffin & Co., Phila., Pa ... 546
American Meter Co., New York and Philadelphia ... 547
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 547
Helme & McIlhenny, Phila., Pa ... 547
D. McDonald & Co. Albany, N. Y ... 547
Nathaniel Tufts, Boston, Mass ... 546
Maryland Meter and Manufacturing Co., Baltimore, Md ... 528
Bell & Jones, Philadelphia, Pa ... 546
Harris Bros. & Co., Philadelphia, Pa ... 546

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 534
Smith & Sayre Manufacturing Co., New York City ... 542
Wilbraham Bros., Philadelphia, Pa ... 535
Connelly & Co., New York City ... 535

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 545
Perkins & Co., New York City ... 544
Newburgh Orrel Coal Co., Baltimore Md ... 545
Despard Coal Co., Baltimore, Md ... 545
Chesapeake and Ohio R, R. Coal Agency, N. Y. City ... 545
Westmoreland Coal Company, Phila., Pa ... 545
J. & W. Wood, New York City ... 544

CANNEL COALS.

Perkins & Co., New York City ... 544
J. & W. Wood, New York City ... 544

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 536
John McLean, New York City ... 536
Chapman Valve Manufacturing Co., Boston, Mass ... 536
R. D. Wood & Co., Phila., Pa ... 542
The P. H. & F. M. Roots Co., Connersville, Ind ... 534

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa..... 512
Clerk Gas Engine Co , Phila., Pa..... 536
Van Duzen Gas Engine Co., Cincinnati, Ohio..... 536

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass..... 535
Ball Engine Co., Erie, Pa..... 528
Westinghouse Machine Co., Pittsburgh, Pa..... 539

STEAM PUMPS.

Van Duzen & Tift, Cincinnati, Ohio..... 527

GAS LAMPS.

G. Shepard Page, New York City..... 536
Welsbach Incandescent Gas Light Co., Phila., Pa..... 529
The Siemens-Lungren Company, Philadelphia, Pa..... 529
Fiske, Coleman & Company, Boston, Mass..... 538

PURIFIER SCREENS.

John Cabot, New York City..... 536
Bartlett, Hayward & Co., Baltimore. Md..... 536

GAS STOVES.

American Meter Co., New York and Philadelphia..... 537
The Goodwin Gas Stove and Meter Co., Phila. Pa 548
George M. Clark & Company, Chicago, Ills..... 529
D. McDonald & Co., Albany, N. Y..... 547
Maryland Meter and Manufacturing Co., Baltimore, Md.... 528
Bell & Jones, Philadelphia, Pa..... 546
Chicago Gas Stove Company, Chicago, Ills..... 528

STREET LAMPS.

J. G. Miner, Morrisania, New York City..... 491
Bartlett Street Lamp Man'fg Co., New York City 527

BURNERS.

C. A. Gefrorer, Phila., Pa..... 544
H. W. Rappleye, Philadelphia, Pa..... 368

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City..... 500

PURIFYING MATERIAL.

Connelly & Co., New York City..... 535
Friedrich Lux, London, England..... 527
Edgewater Lime Works, Edgewater, N. J..... 527

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 545

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City..... 543

BOOKS, ETC.

Gerould's System Gas Bookkeeping..... 538
1889. Directory. 1889..... 535
King's Treatise..... 540
Scientific Books..... 350
Management of Small Gas Works..... 536
Gas vs. Electricity..... 538
Practical Electric Lighting..... 535
Electric Light Primer..... 535
American Gas Engineer and Superintendents' Handbook... 455
Digest of Gas Law..... 527
Fuel and its Applications..... 527
Newbigging's Handbook..... 539

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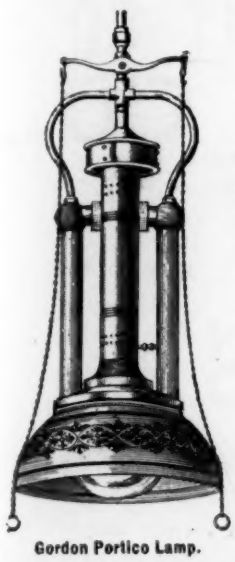
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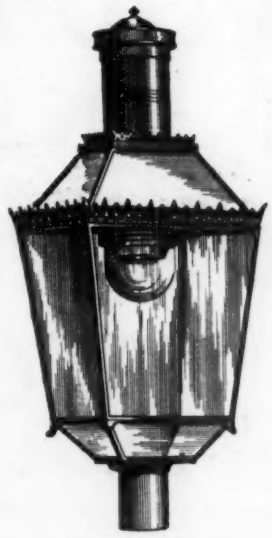
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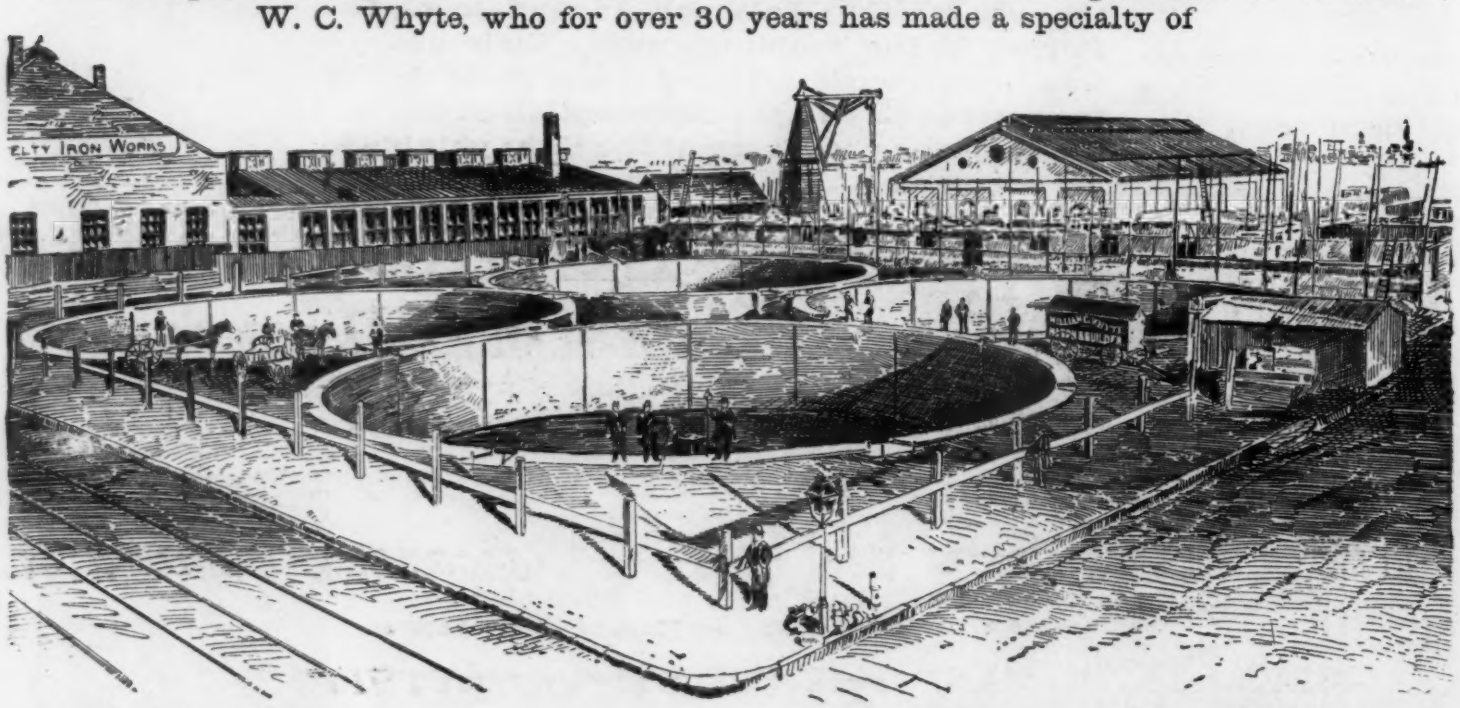

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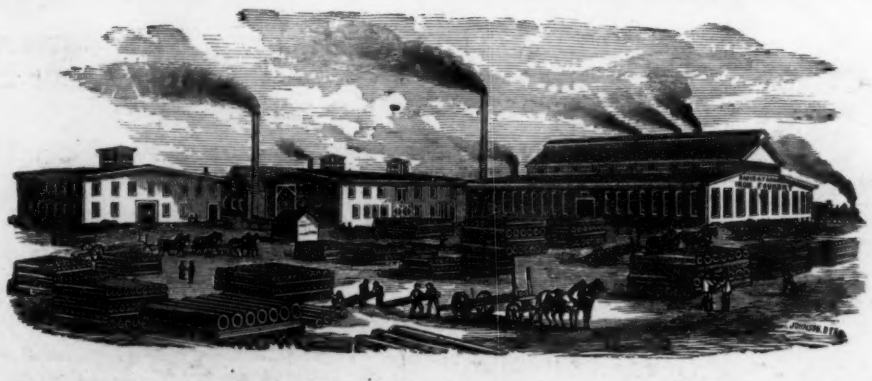

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No. 6,	"	"	1,000,000	"	"	"	8 "	"	"	
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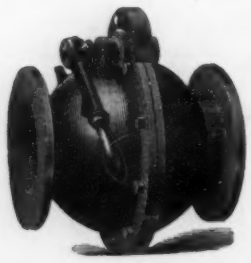

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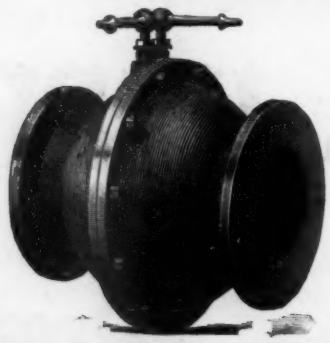

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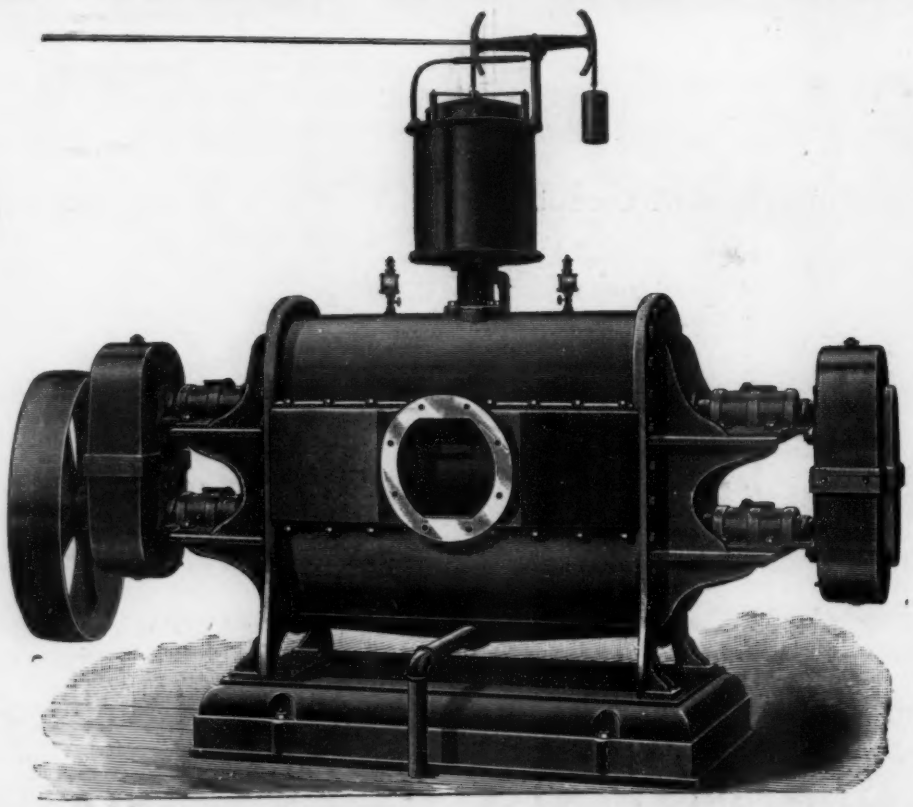

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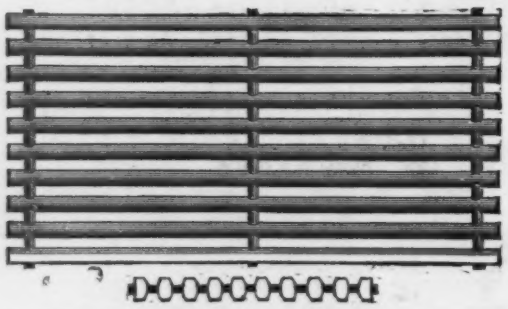

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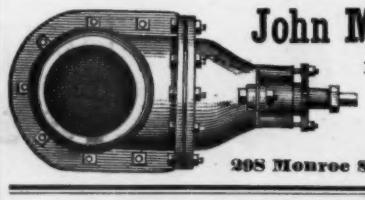

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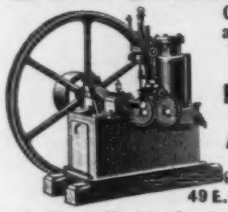

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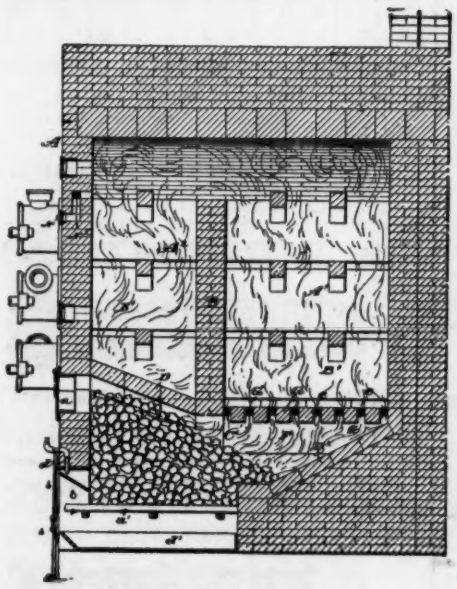

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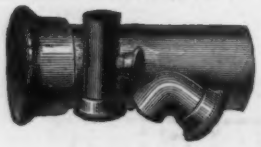

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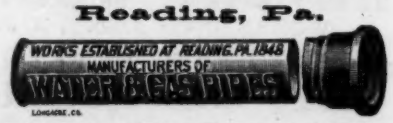

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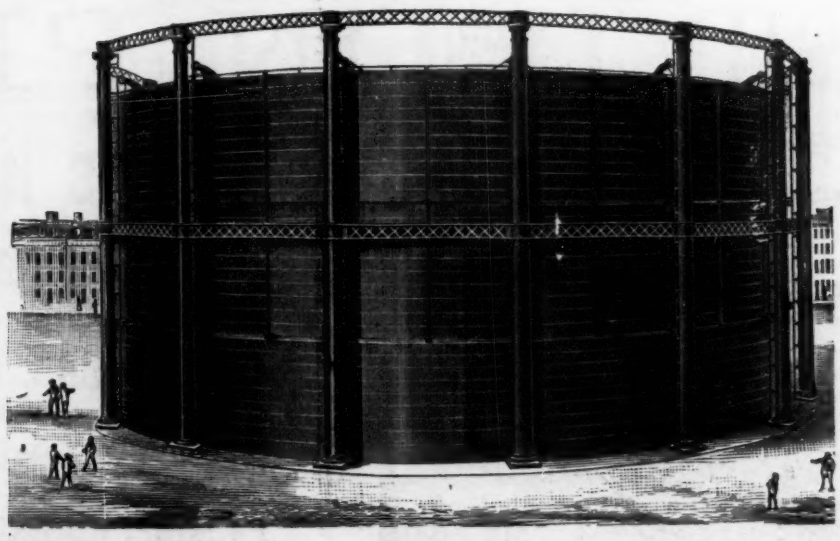

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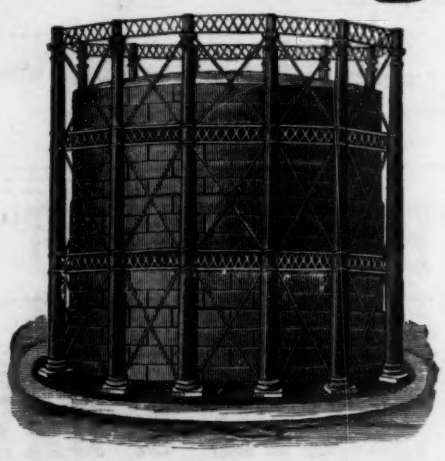

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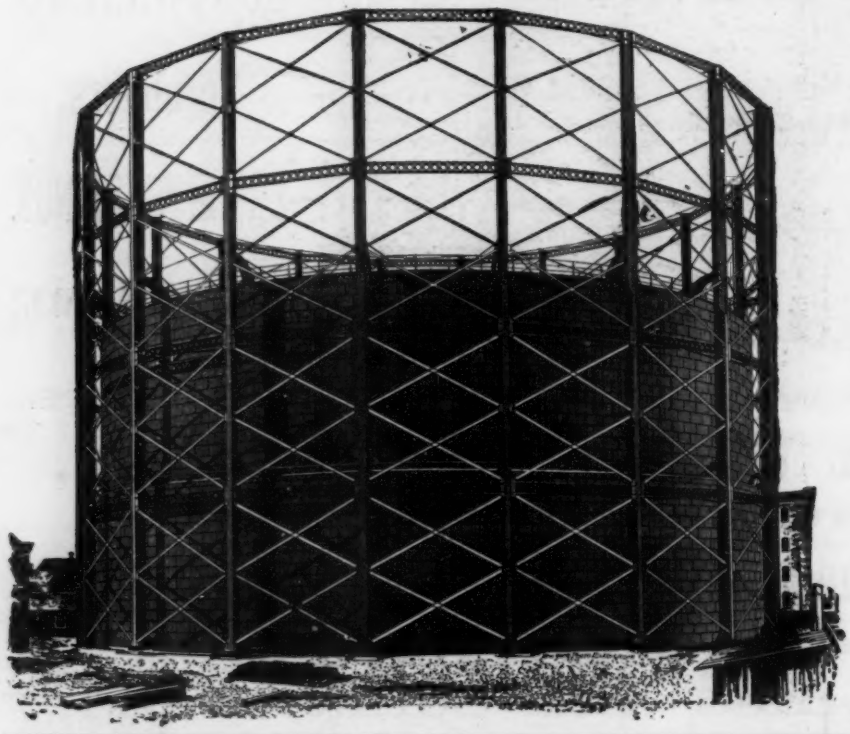

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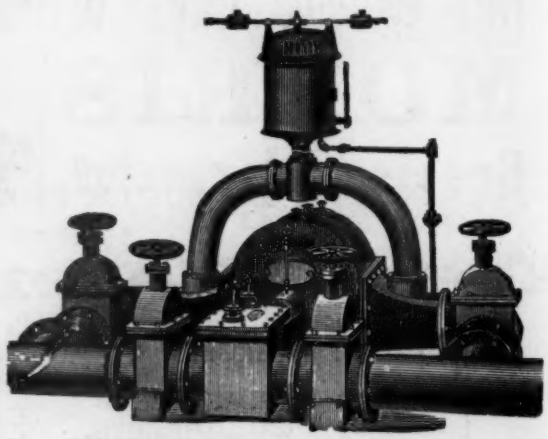

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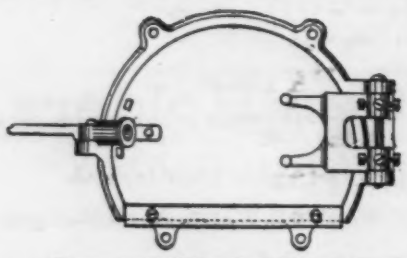

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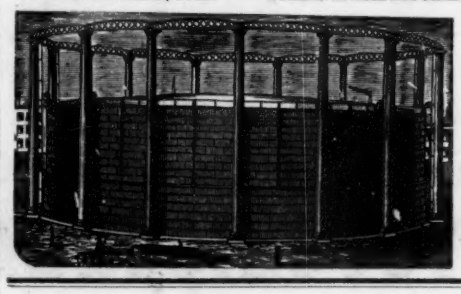

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The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9⅛ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6½ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.